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Nuclear Terrorism and South Asia

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Abstract

Nuclear terrorism involves the actual or potential use of nuclear materials to generate fear to achieve political goals. This study focuses on the use of terror by non-state actors – mainly terrorist groups, but conceivably individual malcontents – through their attainment of some level of nuclear capability or threats to existing nuclear infrastructure. This study assesses the character and extent of the threat of nuclear terrorism. It reviews numerous forms of nuclear terrorism, ranging from the detonation of a nuclear weapon to the use of a nuclear bluff to blackmail a government. The potential political, psychological, economic, health, and social effects of a nuclear terrorist incident are described. National and international measures to combat the threat are discussed. The study then focuses on the specific situation in Pakistan and India, examining their respective political conditions, the terrorist threats faced by them, and their vulnerabilities to nuclear terrorism. It concludes with a series of recommendations on how Pakistan and India can tackle these threats individually as well as through bilateral cooperation based on mutual interests. The role of the United States in strengthening this cooperation and that of the global community in providing a framework for multilateral cooperation are also highlighted.

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Contents

Acronyms

ABNES	Akhil Bharatiya Nepali Ekta Samaj
ADM	atomic demolition munition
AEC	Atomic Energy Commission
AERB	Atomic Energy Regulatory Board
BARC	Bhabha Atomic Research Centre
C3	command, control, and communication
CANDU	Canadian Deuterium Uranium reactor
CIA	(US) Central Intelligence Agency
CICP	(UN) Center for International Crime Prevention
CISF	Central Industrial Security Force
CMC	Cooperative Monitoring Center
CPPNM	Convention on the Physical Protection of Nuclear Material
CTC	Counter-Terrorism Committee
CTR	Cooperative Threat Reduction
DAE	Department of Atomic Energy
DBT	Design Basis Threat
DCC	Development Control Committee
DOE	(US) Department of Energy
DoD	(US) Department of Defense
ECC	Employment Control Committee
EU	European Union
FBI	Federal Bureau of Investigation
HEU	highly enriched uranium
HuM	Harkat ul-Mujahedeen
IAEA	International Atomic Energy Agency
IGCAR	Indira Gandhi Centre for Atomic Research
IMF	International Monetary Fund
IPPAS	International Physical Protection Advisory Service
ISI	Inter-Service Intelligence
JeM	Jaish-e-Mohammed
JUI	Jamiat-ul-Ulema-I-Islam
LeT	Lashkar-e-Taiba
LEU	low enriched uranium
LTTE	Liberation Tigers of Tamil Eelam
MAC	Multi-Agency Center
MCC	Maoist Communist Centre
MW	megawatt
NCA	National Command Authority
NDMA	National Disaster Management Agency
NPT	Treaty on the Nonproliferation of Nuclear Weapons
NSG	Nuclear Suppliers Group
NT	nuclear terrorism
NWFP	Northwestern Frontier Province
ODCCP	(UN) Office for Drug Control and Crime Prevention

PAL	permissive action link
PINSTECH	Pakistan Institute of Nuclear Science and Technology
PNRA	Pakistan Nuclear Regulatory Authority
POTA	Prevention of Terrorism Act
POTO	Prevention of Terrorism Ordinance
PRP	Personnel Reliability Program
PW	People's War
RCA	Regional Cooperative Agreement
RDD	radiological dispersion device
REAC/TS	Radiation Emergency Assistance Center/Training Site
SAARC	South Asia Association for Regional Cooperation
SPD	Strategic Plans Division
TNLA	Tamil Nadu Liberation Army
TNT	trinitrotoluene
TPB	(UN) Terrorism Prevention Branch
US	United States
UN	United Nations
WHO	World Health Organization
WMD	weapons of mass destruction

Nuclear Terrorism and South Asia

Executive Summary

Nuclear terrorism involves the actual or potential use of nuclear materials to generate fear while in pursuit of political goals. This study focuses on the use of terror by non-state actors – mainly terrorist groups, but conceivably individual malcontents – through their attainment of some level of nuclear capability or threats to existing nuclear infrastructure.

This study assesses the character and extent of the threat of nuclear terrorism. It reviews numerous forms of nuclear terrorism, ranging from the detonation of a nuclear weapon to the use of a nuclear bluff to blackmail a government. The potential political, psychological, economic, health, and social effects of a nuclear terrorist incident are described. National and international measures to combat the threat are discussed. The study then focuses on the specific situation in Pakistan and India, examining their respective political conditions, the terrorist threats faced by them, and their vulnerabilities to nuclear terrorism. It concludes with a series of recommendations on how Pakistan and India can tackle these threats individually as well as through bilateral cooperation based on mutual interests. The role of the United States in strengthening this cooperation and that of the global community in providing a framework for multilateral cooperation are also highlighted.

Measures to combat the threat of nuclear terrorism include (1) the use of modern technology (such as sensors) for the detection of nuclear weapons and radioactive materials to interdict unauthorized movement of weapons- or non-weapons-grade fissile materials within a country and across international borders, (2) the use of immigration and border controls to prevent the free movement of terrorists, (3) the control and protection of nuclear weapons, (4) the physical protection of nuclear materials and nuclear facilities, (5) the use of personnel reliability programs to ensure the trustworthiness of persons in sensitive positions, and (6) the use of material access control and accounting measures.

In a world characterized by rapidly increasing communication and the ever-expanding physical movement of people and goods, terrorist threats transcend national boundaries. While a specific nuclear terrorist threat may be aimed at a specific country, the group that makes that threat may choose to target another country later. Or, the ransom extracted may affect the interests of more than one country. The sources of terrorism and the activities of terrorist groups often span national frontiers and measures to avert the threat must be international in scope to be effective.

The community of states as a whole has a common stake in cooperating to suppress nuclear terrorism. Irrespective of their differences, all states share an interest in ensuring that non-state actors do not gain access to nuclear technology and materials for malicious purposes. Cooperation can be bilateral or multilateral. The United States (US) helps secure Russian nuclear weapons and materials against theft through a program of material protection control and accounting. Another project sponsored by the US has helped some Russian facilities pursue more civilian and commercial enterprises to provide job opportunities to Russian nuclear scientists and engineers who have been displaced or are underemployed. The United Nations

(UN) and the International Atomic Energy Agency (IAEA) also play a significant part in addressing nuclear terrorism-related concerns through multilateral political and technical cooperation.

This paper also provides insights on Pakistan's and India's nuclear programs and the nuclear terrorist threats to each.

Pakistan embarked on its nuclear weapons program in 1972 when the then-civilian government decided in principle to explore the nuclear weapons option. However, no concrete measure was pursued until India's first nuclear explosion in May 1974. The control of Pakistan's nuclear weapons program shifted to the Pakistan military in July 1977, but no change occurred in Pakistan's nuclear policy. The decision in May 1998 to explode nuclear devices was made by the then-Prime Minister Nawaz Sharif, but with major input from the military top brass. The West has expressed serious concerns regarding the security of the Pakistan's nuclear arsenal. The most dreaded scenarios envisioned control of Pakistan's nuclear weapons or fissile material slipping into the hands of a pro-Taliban militant Islamic group or sympathizers in the military or the intelligence agencies. However, the size of Pakistan's nuclear program and nuclear arsenal is small, which enables Army authorities to maintain centralized control over nuclear weapons and fissile material. The media reports of a possible US attempt to secure or destroy Pakistan's nuclear weapons and nuclear installations were generally resented in Pakistan, both officially and non-officially. The government of Pakistan took strong notice of these speculative reports and repeatedly assured the international community that its nuclear installations and assets were safe and that additional safeguards had been introduced after September 11, 2001. The most pessimistic scenario for the future of Pakistan and the safety and security of its nuclear arsenal is that Pakistan will increasingly become ungovernable. However, the probability of such a scenario unfolding is minimal. Pakistan's state structure may be under stress, but two of its institutions, the military and the bureaucracy, are sufficiently strong and cohesive to ensure the functioning of the state.

Despite its history of sustained democratization, India has constantly been troubled by terrorist violence. While much attention has been focused on the current secessionist movement of Muslim groups in Kashmir, terrorist threats have always been diverse, encompassing numerous geographical areas, ethnic groups, ideologies, and cross-border spillovers. Of the many groups active today, only the "jihadists" fighting in Kashmir – mostly radicals from outside India – pose a serious nuclear terrorist threat. India's relatively large nuclear infrastructure appears secure. Reactor buildings are strong and well guarded, and nuclear warheads are reportedly stored in an unassembled state. After September 11, security measures have been enhanced. There has been no significant nuclear terrorist threat, but that may be in part a function of a lack of effort on the part of terrorists so far. Terrorists have penetrated and launched attacks in high security zones such as Army camps, ammunition dumps, the national Parliament and, in the case of Indira Gandhi, the Prime Minister's residence. Given this back-drop, the risks of a nuclear terrorist incident occurring remain significant. Hence, there is a need to improve security by, among other things, upgrading monitoring technology, improving organizational coordination, and paying more attention to nuclear sources in hospitals and industries.

The probability of terrorist groups acquiring fully operational nuclear weapons in India and Pakistan is extremely low since both countries are believed to keep them in unassembled form and because their components are stored separately. Terrorists are also unlikely to be able to manufacture an operational nuclear weapon of their own given the difficulties involved in obtaining the required facilities and technical know-how. However, terrorist groups are more likely to resort to other forms of nuclear terrorism. First, they might sabotage a nuclear facility (including a military facility) to release lethal radiation. Second, they could utilize a dirty bomb to disperse radiation. In either case, the result would be widespread panic and violence, perhaps even war. Third, they could take control of and threaten to blow up a nuclear facility in order to blackmail a government into accepting their demands. Fourth, they might engage in the clandestine transfer of nuclear materials out of India and Pakistan for use in another part of the world. Desirable national measures to counter the threat include the following:

1. Continue to track the numerous groups and individuals engaged in overt or covert violence or terrorism in their respective countries.
2. Enhance measures to control the movement of goods and people across international borders.
3. Acquire modern technology and equipment to upgrade the physical security of nuclear weapons components, nuclear materials, and installations, including radioactive waste storage and disposal facilities.
4. Give greater attention to personnel reliability issues in order to minimize insider threats.
5. Acquire the latest technologies for the packaging, sealing, and monitoring of fissile and radioactive materials during transportation.
6. Establish an autonomous and highly trained security force devoted exclusively to protecting nuclear facilities and materials, instead of using agencies that have other assignments as well.
7. Within each country, appoint a coordinating body to integrate the various domestic organizations related to the nuclear infrastructure.
8. Finally, make provisions for disaster management, including emergency response teams for tackling a security alarm or actual nuclear terrorist incident.

Neither India nor Pakistan would want a terrorist group to acquire nuclear capability of any kind. Hence, they have a common interest in cooperating against nuclear terrorist threats. The authors recommend the following measures for bilateral cooperation:

1. Cooperation between the border security authorities of India and Pakistan in interdicting unauthorized movement of goods and people across their boundaries.

2. Monitoring the activities of transnational terrorist groups, exchanging information on these groups, and making joint efforts to disrupt their connections, transactions, and movement could be another measure. An agreement specifically designed to help each other combat nuclear terrorism could encourage cooperation.

3. A formal agreement on maintaining nuclear arsenals in a non-operational form could consolidate the tacit cooperation already in existence. This would not only strengthen strategic stability directly, but also help reduce the scope for terrorists to target nuclear weapons.

The United States can contribute to strengthening the safety and security of their nuclear programs in several ways:

1. The United States could share its knowledge on personnel reliability systems to help protect against the insider threat. Training workshops could be held for Pakistani and Indian personnel and relevant literature (manuals, guidelines and procedures) could be made available to them.

2. The United States could extend useful assistance for safe and secure storage, transport, and disposal of nuclear waste.

3. The United States could help India and Pakistan improve organizational practices to ensure better coordination among various organizations involved in their nuclear programs.

4. The United States could make modern technologies available to India and Pakistan to strengthen the safety and security of their nuclear programs.

The nuclear terrorist threat is global in scope. Continued global cooperation is needed to identify, track down, and apprehend terrorist groups. This will require strengthening of inter-state information exchange and the establishment of arrangements for extradition of terrorists within the framework of the UN. The measures initiated by the IAEA to enhance cooperation with respect to the physical security of civilian nuclear facilities and materials should be continued and intensified. In order to ensure the diffusion of advanced monitoring technologies and best practices, the IAEA should be provided with additional funding and an expanded agenda. The creation of a special fund for assisting countries needing upgraded technology should be seriously considered.

The states possessing nuclear weapons should engage in a similar – perhaps, informal at first – set of arrangements on physical security with respect to military nuclear facilities and materials. Regardless of inevitable tensions over how much information can be given and how much received, some degree of cooperation can be beneficial to all. Here, the authors believe it is necessary to go beyond traditional objections to "rewarding" proliferators: whether nations will or will not obtain nuclear weapons is determined by capabilities and interests, not by vague notions of reward and punishment. Finally, the authors believe that future arms control agreements must eliminate specific weapons fully rather than place large numbers under storage, where they will continue to be potential targets for terrorists.

Nuclear Terrorism and South Asia

1. Introduction

Nuclear terrorism (NT) involves the actual or potential use of nuclear materials to generate fear, while in pursuit of political goals. This study focuses on the use of terror by non-state actors – mainly terrorist groups, but conceivably individual malcontents – through their attainment of some level of nuclear capability or threats to the existing nuclear infrastructure. This could involve the use of stolen nuclear weapons or weapons manufactured from fissile materials[1] such as highly enriched uranium (HEU) and plutonium obtained from military or civilian sources. Nuclear terrorism may also involve the dispersal of radioactive materials in a "dirty" bomb to cause radiological contamination. These materials include fissile materials, natural uranium, nuclear waste, or radionuclides used in medical and health centers, scientific research, and industries. Sabotage of a reactor or other nuclear facility is yet another form of nuclear terrorism.

The twentieth century was witness to the proliferation of diverse weapons of mass destruction (WMD), of which nuclear technology provided the most fearsome potential. The post-Second World War era also saw the growth of terrorism as a political phenomenon. Non-state actors used their advantages – compact organization, mobility, and secrecy – in conjunction with the increasing availability of powerful weapons to wreak destruction against states possessing far greater resources. The period also produced cults like Japan's Aum Shinrikyo and angry, isolated individuals such as the Oklahoma City bomber, who were willing to unleash indiscriminate mass destruction on innocent people. The former case was a rare but frightening one: it involved the practice of WMD terrorism, in this case the release of sarin gas in the Tokyo subway system. The question that troubled security specialists was: With access to nuclear materials, what horrors might a similarly motivated group or individual produce? Numerous studies produced considerable understanding of the dangers of nuclear terrorism and generated efforts to secure nuclear materials and facilities. In the late twentieth century, the growing incidence of terrorist acts by fundamentalist groups such as Osama bin Laden's al-Qaeda accelerated these efforts.

The events of September 11, 2001, galvanized the world into widespread and concerted action. Mohamed El Baradei, Director General of the International Atomic Energy Agency (IAEA), warned that the attacks made it "far more likely" that terrorists would target nuclear facilities, and that states had to cooperate to stop them because "radiation knows no frontiers."[2] In particular, there was a growing fear that al-Qaeda was engaged in a serious effort to acquire nuclear capability.[3] This in turn brought close attention to the turbulent political situation in South Asia. Al-Qaeda, held responsible for the September 11 acts, was then based in Afghanistan, adjacent to Pakistan and India. Both countries have developed nuclear programs

[1] Fissile materials are those nuclear materials that are able to explode because of an uncontrolled nuclear chain reaction, under suitable conditions. They are the essential materials for making a nuclear weapon.

[2] "Calculating the New Global Atom Threat," Press Release, International Atomic Energy Agency, November 1, 2001. http://www.iaea.or.at/worldatom/Press/P_release/2001/nt_pressrelease.shtml

[3] Philip Webster and Roland Watson, "Bin Laden's Nuclear Threat," *Times*, October 26, 2001; Anthony Loyd, "Bin Laden's Nuclear Secrets Found," *Times*, November 15, 2001.

and are plagued by civil strife, terrorism, and threats to political stability. Some of Pakistan's extremist Islamic groups had close ties with the Taliban, which facilitated their interaction with al-Qaeda. In the past, the government of Pakistan had maintained a friendly disposition towards the Taliban regime and supported them in intra-Afghan strife. Terrorist groups based in Pakistan were active in India.

The international community became acutely sensitive to the possibility of al-Qaeda and other terrorist groups acquiring fissile and radioactive materials from the region, or attacking its nuclear facilities. These groups, it was feared, would be motivated by a desire for retaliation against the decision of India and Pakistan to join the United States (US)-led campaign in Afghanistan. The groups were particularly incensed with the Pakistan government, whose decision to join the United States was viewed by them as a betrayal. While some of these fears may have been exaggerated, the nuclear terrorist threat to the region cannot be discounted.

This study is an effort to assess the character and extent of the threat of nuclear terrorism. It reviews numerous forms of nuclear terrorism, ranging from the detonation of a nuclear weapon to the use of a nuclear bluff to blackmail a government. The potential psychological, social, political, and economic effects of a nuclear terrorist incident are enumerated. National and international measures to combat the threat are discussed. The study then focuses on the specific situation in Pakistan and India, examining their respective political conditions, the terrorist threats faced by them, and their vulnerabilities to nuclear terrorism. It concludes with a series of recommendations on how Pakistan and India can tackle these threats individually as well as through bilateral cooperation based on mutual interests. The role of the United States in strengthening this cooperation and that of the global community in providing a framework for multilateral cooperation are also highlighted.

2. Dimensions of Nuclear Terrorism

A great deal has been written about terrorism, but the term has not always been clearly defined. Terrorism is often equated with the use of violence by non-state actors for political ends; but that is also true of insurgency, or guerrilla warfare. Terrorism has also been defined as "violence or threatened violence intended to produce fear or change."[4] A more careful definition offered by the International Institute for Strategic Studies, London, and the one used in this paper, is "the use of violence, often against people not directly involved in a conflict, by groups operating clandestinely, which generally claim to have high political or religious purposes, and believe that creating a climate of terror will assist attainment of their objectives."[5] This is not entirely complete, since it omits state terrorism, in which states directly or indirectly seek the same objectives and use the same methods. In practice, however, states are unlikely to sponsor terrorist acts involving WMD, since loss of control over terrorist groups that possess WMD capability could have extremely adverse consequences for them.[6]

Nuclear terrorism involves the actual or potential use of nuclear materials to generate fear in the pursuit of political ends. *Nuclear terrorist incidents* include the acquisition of, use or threatened use of, or attack on nuclear materials or facilities, as well as the resort to false threats or hoaxes that, to the extent they are convincing, would have the same effect.[7] The materials that could conceivably be used encompass manufactured or stolen nuclear weapons (not necessarily of a sophisticated variety), and fissile materials such as HEU and plutonium. A sub-category of nuclear terrorism is *radiological terrorism*, which involves the use of radioactive materials – perhaps in conjunction with regular explosives – to disperse radioactivity only to contaminate the environment. The range of possible terrorist actions is wide, and the following list is indicative rather than exhaustive:

- A hoax threatening a nuclear explosion or the release of radioactivity in a populated area;
- The takeover of a nuclear plant or seizure of materials during transportation, followed by the threat of a radioactive release;
- Release of radioactivity in an isolated area as a warning of impending damage at a higher level;
- An attack on nuclear materials during transportation so as to cause a release of radio-activity;

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[4] Jonathan R. White, *Terrorism: An Introduction* (1991, incomplete citation), cited in *Political Terrorism Database*. http://polisci.home.mindspring.com/ptd/ptd_definition.html

[5] "Defining Terrorism: Focusing on the Targets," *Strategic Comments*, 7, 9 (2001). http//:www.iiss.org. stratcomsubarchive.php?scID=193

[6] Gavin Cameron, *Nuclear Terrorism: A Threat Assessment for the 21st Century* (Basingstoke and London: Macmillan; New York: St. Martin's Press, 1999), pp. 10-12.

[7] For a chronology of WMD terrorism incidents, including hoaxes, see Jason Pate, Gary Ackerman, and Kimberly McCloud, *2000 WMD Chronology: Incidents Involving Sub-national Actors and Chemical, Biological, Radiological, or Nuclear Materials*, Center for Nonproliferation Studies, Monterey Institute for International Studies. http//:cns.miis.edu/pubs/reports/cbrn2k.htm

- A radiological attack on symbolic targets with a relatively immediate impact, e.g., a national monument or a major public building;
- A radiological attack on industrial targets, e.g., factories, ports, and office complexes;
- A radiological attack on government centers and military targets;
- A conventional attack on a nuclear reactor or a waste storage/disposal site;
- A radiological attack on urban concentrations with intent to maximize fatalities; and
- A nuclear blast aimed at any of the targets identified above.

The actual physical damage may range from the nonexistent to the horrific, but the common effect will be to create terror in the minds of the public, which is the desired end of the terrorist.

2.1. Terrorist Goals and the Nuclear Threshold

A world in the throes of globalization and the uncertainties it has engendered is fertile soil for the terrorist. The erosion of traditional identities, combined with the disparities and insecurities produced by economic change, have given rise to growing anger and frustration, to "marginalized subcultures" and to "selective technopolitical rage."[8] Terrorists are driven both by strategic reasoning and by deep psychological motivations. As rational calculators, they may resort to violence because they lack adequate mass support, because they are subject to severe repression, or perhaps because of a need to seize upon a critical moment of government weakness or the infusion of new resources.[9] At the same time, terrorists are also creatures of a "special psycho-logic": often propelled by a pattern of educational and vocational failure and a sense of social rejection; they are aggressive, stimulus-hungry, and prone to violence against those in whom they seek to project their own failures.[10] Group pressures tend to propel individuals across the threshold of violence, and sometimes to encourage a higher level of bloodshed.

What might motivate a terrorist to "go nuclear"? The history of terrorist mass destruction is a relatively sketchy and short one.

The resort to nuclear terrorism, with its potential for mass annihilation, appears to have inherent constraints from the rational standpoint. Indeed, there are very few examples of mass

[8] Paul Schulte, "Motives and Methods of Future Political Violence: Landscapes of the Early 21st Century," in Yonah Alexander and Milton Hoenig, eds., *Super Terrorism: Biological, Chemical and Nuclear* (Ardsley, NY: Transnational Publishers, 2001), p. 46.

[9] Martha Crenshaw, "The Logic of Terrorism: Terrorist Behavior as A Product of Strategic Choice," in Walter Reich, ed., O*rigins of Terrorism: Psychologies, Ideologies, Theologies, States of Minds* (Cambridge: Cambridge University Press, 1990).

[10] Jerrold M. Post, "Terrorist Psycho-logic: Terrorist Behavior as a Product of Psychological Forces," in Reich, ed., O*rigins of Terrorism*; Cameron, *Nuclear Terrorism*, Ch. 2.

killing by terrorists over the past hundred years or so.[11] Terrorists have numerous reasons for eschewing a strategy of mass casualty attacks.[12] They usually want to create fear, not revulsion. As Brian Jenkins puts it, "terrorists want a lot of people *watching*, not a lot of people *dead*."[13] Resorting to mass killing can alienate not only the public, but members of a terrorist organization as well. Terrorists have numerous alternatives that can accomplish the objective of creating widespread fear with less difficulty, such as hijackings, bomb blasts, and kidnappings. For those who want to exterminate large numbers, as in the "ethnic cleansing" that has occurred in recent times in Rwanda and Bosnia, simple weapons are sufficient. Besides, most terrorist groups wish to displace governments, and hence they behave – at least to some extent – like governments themselves, which places a constraint on unrestrained and indiscriminate violence.[14] Above all, coercive strategies rarely succeed because governments resort to greater repression, and hardly ever make major concessions.

Nuclear terrorist threats have been rare, and have never actually been carried out. In 1985, for instance, an "Armenian Scientific Group" threatened to destroy Turkey's major cities by exploding three nuclear devices, but nothing came of it.[15] In 1995, evidently on information provided by a rebel Chechen leader, a Russian television crew found a small quantity of cesium-137 in a Moscow park.[16] However, two terrorist groups have actually carried out acts of mass violence. Aum Shinrikyo, the Japanese cult group that conducted a chemical weapons attack in the Tokyo subway in 1995, is known to have attempted (unsuccessfully) to acquire nuclear capability. More recently, Osama bin Laden's al-Qaeda is also known to have tried to obtain nuclear material and technology. History does not appear to be an adequate guide to the future. Indicators of a new trend toward mass killing warn of an increased risk of nuclear terrorism in times to come.[17] The steady diffusion of technical knowledge means there is an ever-growing pool of capable individuals from which terrorist groups can draw. Nuclear materials are widely distributed around the world and are secured inadequately in some facilities. Above all, the rise of religion-based terrorism and of doomsday cults has been accompanied by ever-higher levels of violence, as manifested in the September 11 attacks in the United States. Religious terrorists are less inhibited in their destructiveness because their ultimate audience is not the government or the public, but God. For them, violence becomes "a sacramental act, dictated and legitimized by theology."[18] The biggest threats come from "megalomaniacal hyperterrorists," individuals who dream of altering the trajectory of history through great acts of destructive transformation.[19]

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[11] Richard A. Falkenrath, Robert D. Newman, and Bradley A. Thayer, *America's Achilles Heel: Nuclear, Biological, and Chemical Terrorism and Covert Attack*, (Cambridge, MA, and London: MIT Press, 1998), p. 47, Table 1.

[12] Falkenrath, Newman, and Thayer, *America's Achilles' Heel*, pp. 45-59.

[13] Brian M. Jenkins, "Is Nuclear Terrorism Plausible?" in Paul Leventhal and Yonah Alexander, eds., *Nuclear Terrorism: Defining the Threat* (McLean, VA: Pergamon-Brassey's International Defense Publishers, 1986), p. 28.

[14] Jenkins, "Is Nuclear Terrorism Plausible?" p. 29.

[15] Jenkins, "Is Nuclear Terrorism Plausible?" p. 28.

[16] William Potter, "Less Well-Known Cases of Nuclear Terrorism and Nuclear Diversion in the Former Soviet Union," Nuclear Threat Initiative website, August 1997. (http://www.nti.org/db/nisprofs/over/nuccases.htm) Some half a dozen other cases cited by Potter are of a criminal nature, and would not fall into the category of terrorism as defined above.

[17] Falkenrath, Newman, and Thayer, *America's Achilles' Heel*, pp. 168-215.

[18] Falkenrath, Newman, and Thayer, *America's Achilles' Heel*, p. 184.

[19] Ehud Sprinzak, "The Lone Gunmen," *Foreign Policy*, (November–December 2001). http://www.foreignpolicy.com/issue_novdec_2001/sprinzakhyper.html

Though they may act alone (as did Timothy McVeigh, the Oklahoma bomber), they often show a capacity to organize and lead terrorist groups (bin Laden of al-Qaeda, Shoko Asahara of Aum Shinrikyo, and Ramsey Yusuf, who masterminded the World Trade Center bombing of 1993). Hence, bin Laden's exhortation to Muslims in *The Nuclear Bomb of Islam* to do their "duty" and "prepare as much force as possible to terrorize the enemies of God" has to be taken very seriously.[20]

The major threats posed by nuclear terrorism are as follows:

1. Acquisition and Development of Nuclear Weapons and Components

Terrorists might be able to steal or, more likely, use force to acquire a nuclear weapon. Whether tactical or strategic, the ability of terrorists to use these weapons would be dependent on the level of built-in safeguards. Sophisticated weapons are less vulnerable because protective devices, such as permissive action links (PALs) implemented in the United States, would make it virtually impossible to utilize them as they are. However, depending on the design, they might be dismantled and reassembled into workable weapons. Unassembled weapons might also be assembled and used. The assembly of a weapon would, of course, require a high degree of sophistication. It is also possible for terrorists to steal nuclear bomb components in order to make their own weapon. Not least, the mere possession of a stolen nuclear weapon would enhance the "capability" of a terrorist group. Whether the weapon is workable or not, those at the receiving end of a threat cannot afford to assume that it will not work.

Basic bomb designs are not hard to obtain or develop, since the technical knowledge has now been publicly available for many years. More difficult are the tasks of obtaining fissile material and employing the techniques that go into the actual fabrication of a nuclear bomb. Global stockpiles of fissile material are large, amounting to some 450 tons of plutonium and over 1,700 tons of HEU.[21] (Other estimates are higher.) Though most of these are held by the five major nuclear states, considerable quantities also exist in Belgium, Germany, Japan, India, Israel, and Switzerland. In addition, research reactors in 43 countries have more than 2,772 kilograms of HEU. The global stock of raw uranium that could be converted into fissile material or used directly for radiological terrorism is estimated to be close to 65,000 tons.[22] Despite the considerable efforts and resources devoted to guarding these inventories, the possibility for leakages is substantial.

Major sources of such leakages have been the successor states of the Soviet Union, especially Russia. William Potter has identified seven cases of diversion of significant quantities of nuclear material, and four other possible cases.[23] More alarming, a February 2002 assessment by the US National Intelligence Council states that undetected diversion of weapons-grade and weapons-usable materials has taken place from Russian institutes, but "we do not know the

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[20] Cited in Jim Puzzanghera, "Possibility for Nuclear Terror Too Real to Be Ignored," *Mercury News Washington Bureau*, October 14, 2001.

[21] M. Bunn and G. Bunn, "Reducing the Threat of Nuclear Theft and Sabotage," International Atomic Energy Agency, n.d., IAEA-SM-367/4/08.

[22] "World Nuclear Power Reactors 2000-2001 and Uranium Requirements," World Nuclear Association, June 2002. http://www.world-nuclear.org/info/reactors.htm

[23] Potter, "Less Well-Known Cases of Nuclear Terrorism and Nuclear Diversion in the Former Soviet Union."

extent or magnitude of such thefts."[24] Russia is estimated to possess 150 tons of weapons-grade plutonium, 1,000 tons of enriched uranium, and, at the Chelyabinsk complex alone, 685,000 cubic meters of radioactive waste.[25] Given the reality of poor accounting, organizational deterioration because of adverse economic conditions, and inadequate physical controls, it is not surprising that there are numerous examples of material diversion, more often than not by insiders.[26] Moreover, projections of Russian weapons inventories show that, over the next decade, about 3,500 warheads containing approximately 84,000 kilograms of fissile material will be removed from deployment.[27] Besides material diversion, it is also possible for small atomic weapons, known as atomic demolition munitions (ADMs, also loosely referred to as "suitcase nukes"), to be stolen. Though much attention today is centered on Russia, other sources of material and/or components do exist. Thomas Davies has pointed to lax standards of security during the transport of HEU in Europe, and to the purchase of three disarmed but workable short-range missiles by a junk dealer in the United States.[28]

The possibility of a workable nuclear weapon being assembled by a terrorist group cannot be discounted.[29] A relatively simple gun-type nuclear weapon design (such as that used for the Hiroshima bomb) involves the firing of a subcritical HEU projectile into a subcritical HEU target to achieve a (supercritical) nuclear chain reaction. A more difficult implosion type design (Nagasaki type) requires a near-critical piece of fissile material (uranium or plutonium, possibly uranium oxide or plutonium oxide) to be compressed by the detonation of a surrounding high explosive in order to achieve supercriticality. The amount of material required depends upon several factors, including what material is used and how the weapon is designed, but even the minimum amount is several kilograms for plutonium and tens of kilograms for HEU.[30] Even though the designs for less sophisticated bombs may require less material, the amount of material required is still large (multiple kilogram-quantities). The making of a bomb would take considerable time (months, at best) and require extensive expertise with different specializations in metallurgy, neutronics, radiation effects, high explosives, hydrodynamics, and electronics. The end product in the case of a simple design would be a large and unwieldy bomb weighing over a ton. More manageable sizes would involve more difficult processes.

However, very crude devices, sometimes with very limited effects, would still be possible. Reactor-grade plutonium from a commercial light-water reactor could be used to develop a bomb with a relatively small yield of one or a few kilotons. Even if this does not work very well, because reactor-grade plutonium tends to "pre-initiate" on account of spontaneous fission

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[24] Jon B. Wolfsthal and Tom Z. Collina, "Nuclear Terrorism and Warhead Control in Russia," *Survival*, 44, 2 (Summer 2002), p. 71.
[25] Cameron, *Nuclear Terrorism*, p. 2.
[26] Cameron, *Nuclear Terrorism*, pp. 2-13.
[27] Wolfsthal and Collina, "Nuclear Terrorism and Warhead Control in Russia," p. 73.
[28] Thomas D. Davies, "What Nuclear Means and Targets Might Terrorists Find Attractive?" in Leventhal and Alexander, eds., *Nuclear Terrorism*, pp. 58, 63.
[29] Carson Mark, Theodore Taylor, Eugene Eyster, William Maraman, and Jacob Wechsler, "Can Terrorists Build Nuclear Weapons?" Nuclear Control Institute, n.d., http://www.nci.org/k-m/makeab.htm; Milton Hoenig, "Terrorists Going Nuclear," in Alexander and Hoenig, eds., *Super Terrorism*; Falkenrath, Newman, and Thayer, *America's Achilles' Heel*, pp. 126-136.
[30] Falkenrath, Newman, and Thayer, *America's Achilles' Heel*, p. 131; Hoenig, "Terrorists Going Nuclear," p. 34; Mark et al., "Can Terrorists Build Nuclear Weapons?"

of some of its components, the resultant "fizzle yield" would still yield a devastating blast.[31] On the whole, it would seem that the obstacles in the path of nuclear bomb making are sufficiently difficult in terms of availability of knowledge and materials to make the prospect appear very low. Nevertheless, the possibility cannot altogether be ruled out.

2. The Insider Threat

A serious potential threat to nuclear facilities, whether military or civilian, comes from insiders. The range of possible threats includes theft of materials; support to outsiders by way of disruption of alarm systems; sabotage of facilities or specific processes (such as reactor cooling systems); and simple acts such as providing building layouts or access codes to terrorists.[32] Most acts of sabotage have been caused by disgruntled employees who have expressed their anger by, among other things, cutting electrical cables, setting fires, or destroying security cameras.[33] Most nuclear-related organizations are also vulnerable to cyber-security threats: information on any aspect of a nuclear facility from bomb design to security measures could be misappropriated by an insider.[34] It is important to recognize that the insider threat applies to military facilities too. Herbert Abrams has illustrated the seriousness of the problem by recording the significant levels of psychiatric disorders and drug and alcohol abuse, as well as of actual violent acts by military personnel cleared through personnel reliability screening programs.[35] While this study applies to the US armed forces, there is no reason to believe that military personnel elsewhere are significantly different in their behavior patterns.

3. Acquisition and Use of Materials for Radiological Terrorism

Apart from fissile material, large quantities of radioactive material are available around the world. Terrorists could utilize these for contaminating the environment in diverse ways, from direct contamination of food and water to exploding a radiological dispersion device (RDD), or "dirty bomb," which would use conventional explosives to disperse radioactive material. Radioactive materials are commonly used for nonmilitary purposes. According to a recent count, there are 283 research reactors operating in 56 countries employed in nuclear research, environmental science, advanced materials development, the drug design, and nuclear medicine for numerous purposes.[36] Hospitals and medical research centers widely use nuclear materials known as radioisotopes such as cobalt-60 (external radiation therapy), iodine-131, iridium-192 (both for internal therapy), and technetium-99 (for imaging).[37] Less well known is the widespread and increasing use of radioisotopes in industry, such as americium-141 (smoke detection and measuring ash content in coal), cesium-137 (identification of sources of soil erosion and deposition), cobalt-60 (sterilization of food and medical products) and tritium (exit

[31] Hoenig, "Terrorists Going Nuclear," pp. 35-36.
[32] Daniel Hirsch, "The Truck Bomb and Insider Threats to Nuclear Facilities."
[33] "The Insider Sabotage Problem," Three Mile Island Alert, n.d. http://www.tmia.com/sabter.html
[34] Project on Government Oversight, *US Nuclear Weapons Complex: Security at Risk*, pp. 21-23.
[35] Herbert L. Abrams, "Human Reliability and Safety in the Handling of Nuclear Weapons," *Science & Global Security*, 2 (1991), pp. 1-26.
[36] "Research Reactors," World Nuclear Association, July 2001. http://www.world-nuclear.org/info/ inf61print.htm
[37] "Radioisotopes in Medicine," World Nuclear Association, May 2001. http://www.world-nuclear.org/info/ inf55.htm

signs and watch dials).[38] The extent of the problem is hard to estimate, but it is known that even in countries where security regulations are tight, considerable leakage occurs. For instance, the IAEA disclosed in June 2002 that US companies had lost track of as many as 1,500 radioactive sources since 1996, over half of which remained untraced.[39]

The extent of damage that terrorists can cause by using such materials to create a dirty bomb depends primarily on three factors.[40] The size of the conventional explosive used would determine the extent of dispersion of radioactivity, and the quantity and quality of the radioactive material would determine its relative lethality. Contrary to a common perception, the potential for contaminating water supply on a large scale is negligible. Most radioactive material is not soluble in water and would either settle or be trapped in filters, and in any case, the quantity of material required to contaminate large bodies of water would be very great.[41] As a way of estimating the potential effects of such materials, it bears noting that in 1987, a 20-gram capsule of cesium-137 stolen by a gang of thieves in Brazil caused 4 deaths, 14 cases of radiation burns, and 249 cases of contamination.[42] A report produced by the Federation of American Scientists undertook three hypothetical case studies of dirty bombs being exploded over urban concentrations using cesium, cobalt, and americium. The study found that, while immediate casualties would be few, there would be a significant number of cancer deaths, high levels of cancer risk over fairly large areas, and the need to evacuate and decontaminate or rebuild much of the contaminated area. For instance, if a typical quantity of americium used for oil well surveys were to be blown up with one pound of TNT, an area covering 20 city blocks would have to be evacuated within half an hour, and, if an area of 60 city blocks had to be rebuilt, the cost could be more than $50 billion.[43] The most powerful effects would be panic, social tension, and the undermining of societal stability.

4. Sabotage: Nuclear Plants, Storage, and Transport

Nuclear power plants are subject to a wide set of potential threats. Plants are designed to be protected from a range of credible threats – captured by the concept of the "Design Basis Threat" (DBT), which anticipates direct attacks from the ground, air, and possibly water.[44] Some current DBTs do not take into account some worst-case scenarios that are difficult to ignore after September 11. The destruction of the World Trade Center has brought particular attention to the potential effects of a large passenger plane crashing into a nuclear reactor. Such a threat was actually made in the United States in 1972, when hijackers warned they would crash

[38] "Radioisotopes in Industry," World Nuclear Association, November 2001. http://www.world-nuclear.org/info/inf56.htm

[39] Serge Schmemman, "Agency Says 'Dirty Bomb' Could Be Made in Any Country," *New York Times*, June 26, 2002.

[40] "Dirty Bombs," Transcript of Online Discussion with Jim Walsh, Washingtonpost.com, June 10, 2002. http://discuss.washingtonpost.com/wp-srv/zforum/02/walsh061002.htm

[41] First Annual Report to the President and the Congress of the Advisory Panel to Assess Domestic Response Capabilities for Terrorism Involving Weapons of Mass Destruction, December 15, 1999, RAND, Washington, D.C.

[42] Mark Henderson, "Terrorists 'Could Make Atom Bomb by Raiding Hospitals,' " *The Times* (London), November 1, 2001.

[43] *Public Interest Report*, 55, 2 (March/April 2002), pp. 2, 6-10.

[44] For a more detailed discussion of Design Basis Threats, see Project on Government Oversight, *US Nuclear Weapons Complex: Security at Risk*, Washington, D.C., October 2001, pp. 9-11. Threats from water sources are not discussed in the report.

a Southern Airways jetliner into the Oak Ridge nuclear weapons complex, but did not carry it out.[45] Aircraft engines, the most rigid parts, could possibly penetrate the containment structure and cause a major fire or explosion, releasing radioactivity on a massive scale.[46] Some nuclear power plants may be ill equipped to counter certain levels of a sophisticated armed attack. For instance, a large, properly placed truck bomb could have a similar effect as above, destroying the cooling systems and breaching the containment structure of a reactor, and causing a meltdown and possible dispersal of radiation.[47] Armed ground assaults might also be launched to take over plants temporarily and indulge in sabotage, perhaps by destroying safety systems. Generally, spent fuel pools contain more hazardous material than reactors, and are less well protected than reactor buildings. While most spent fuel pools are underground, they are vulnerable: should the cooling system be damaged, or if a crack allowed the cooling water to escape, the spent fuel would either melt or burn, causing radiation to spread.[48] In the case of dry storage, spent fuel casks can be penetrated by armor-piercing shells or blown up.[49] This kind of sabotage has the potential to cause significant contamination.

Nuclear materials are particularly vulnerable to sabotage during transportation.[50] This includes the transportation of nuclear materials within a nuclear power complex. Methods of attack may include using armor-piercing shells to penetrate storage casks; capturing and blowing up casks; destroying the transportation infrastructure, such as a bridge or tunnel during movement of nuclear material; and causing high-speed derailment of rail cars. The kind of damage caused to the *USS Cole* in Yemen may also damage or sink a ship carrying nuclear materials. In addition, nuclear weapons or their components (separated cores, unmated warheads) may also be subject to attack during transportation.

2.2. How Serious Is the Threat?

It is still a matter of debate as to whether nuclear terrorism is a likely prospect, given the numerous obstacles that have prevented it from occurring so far. First, for many terrorists, an act of *nuclear* terror would be politically inexpedient as well as morally unacceptable. Second, terrorists may have the will, but lack the capability. Building a nuclear bomb is a very difficult task, as several nations with considerable resources at their command have found. Nuclear weapons and facilities are generally well guarded. Even a dirty bomb may be hard to make, as

[45] Duncan Mansfield, "Hijacked Plane Targeted Nuclear Complex," *Washington Post*, September 19, 2002.
[46] "Security of the Nation's 103 Nuclear Reactors," Transcript of News Conference, Nuclear Control Institute and Committee to Bridge the Gap, Washington, D.C., September 25, 2001.
[47] Daniel Hirsch, "The Truck Bomb and Insider Threats to Nuclear Facilities," Nuclear Control Institute, 1987, http://www.nci.org/g-h/hirschtb.htm; Project on Government Oversight, *U. S. Nuclear Weapons Complex: Security at Risk*, p. 20.
[48] Alden Meyer, "New UCS Fact Sheet on Spent Fuel Security," *World Information Service on Energy*, Washington, D.C., http://www.antenna.nl/wise/terrorism/10232001us.html; "Nuclear Reactor Security," Union of Concerned Scientists, http://www.ucsusa.org/energy/br_safenplants.html; Paul Choiniere, "Officials Taking a Second Look at Plant Security," TheDay.com, September 19, 2001, http://www.nci.org/01/09/19-10.htm
[49] "Castor and Terror," *World Information Service on Energy*, Washington, D.C., November 23, 2001. http://www.antenna.nl/wise/terrorism/11222001wis.html
[50] State of Nevada, Nuclear Waste Project Office, Fact Sheet: Terrorism Considerations in the Transportation of Spent Nuclear Fuel and High-Level Radioactive Waste," n.d. http://www.state.nv.us/nucwaste/yucca/ terrfact.htm

the handling of radioactive materials is a difficult business.[51] Third, any number of targets, such as city centers and symbolic buildings, are easier to attack with conventional explosives and can yield the same results – in terms of public fear – that terrorists seek. Fourth, other means of mass destruction are more easily available. While chemical and biological weapons may be hard to utilize in such a way as to cause very large-scale damage, their capacity to produce fear is immense, as we know from the public effects of the anthrax attacks in the United States in 2001.

On the other hand, it is also true that the incidence of mass casualty terrorism, backed by extremely atavistic mindsets, is rising. While no incidence of nuclear terrorism has as yet occurred, there is clear evidence of interest in it on the part of Aum Shinrikyo and al-Qaeda. Other materials may be available, but there is little doubt that nuclear technology has an unrivalled quality as a mechanism to generate fear. A nuclear bomb may be difficult, but not impossible, to make; a dirty bomb is well within the capacity of many. Those who wish to inflict apocalyptic destruction do manage to find and train cadres with no fear for their lives, and hence the readiness to handle dangerous materials without abundant caution. Risk is often measured as a product of the likelihood of the occurrence and the potential consequences of an event. While the probability of the required knowledge and materials falling into the wrong hands may not be great, it cannot be ruled out. Above all, the events of September 11 demonstrated that the past is not always an adequate guide to the future. The chances of an act of nuclear terrorism occurring may be relatively low, but the potential consequences are sufficient to demand that we take the risk very seriously indeed.

[51] Mohamed El Baradei, "Dirty Bombs: Assessing the Threat," *Washington Post*, July 2, 2002.

3. Potential Effects of Nuclear Terrorism

Terrorist groups can resort to nuclear terrorism through both the threat of an event and the actual occurrence of an event. The impact of nuclear terrorism would depend on a host of factors that should be considered for devising an appropriate response.

The impact of the threat of an event would depend on the credibility of the terrorist group and the nature of the threat. The track record and the known capabilities of the terrorist group would, to a great extent, determine the credibility of a threat. Furthermore, the nature of the threat would have to be taken into account. Is it a threat of detonation of a nuclear weapon, dispersal of radioactive materials, an explosion of a dirty bomb, or an attack on a nuclear facility? In the case of a threat, the response would focus on dissuading the terrorist group from carrying out its threat as well as on preparing to deal with the consequences of the implementation of the threat. If the terrorist group resorts to nuclear terrorism without warning, the focus would be on consequence management, including efforts to apprehend the culprits.

The following factors are important for assessing the impact of an actual occurrence of an event:

- The nature of the explosion/attack and the material used
- The means of dispersal
- Major characteristics of the population in the affected areas
- Weather and environmental factors
- Management capacity of the administration
- The period of public exposure to radioactivity

In the case of a weapon scenario, it is important to understand the nature and contents of the explosion: is it a nuclear explosion or a dirty bomb that uses conventional explosives to spread radioactive material? Its impact depends on the nature and amount of radioactive material released and the means by which it is dispersed. Candidate radioactive materials include cesium-137, strontium-90, cobalt-60 and iridium-192.[52] These materials could be stolen from nuclear facilities or unprotected research centers, industrial or medical establishments, food irradiation plants, or oil drilling facilities. The early determination of the radiation's type and the strength and the mode of dispersal are extremely important to deal with its impact. Communicating this information to the government, local administration, and the population is important to avert rumors and a mass scare.

The characteristics of the population in the affected area need to be taken into account. Is it a residential or commercial area? The density of population and its major characteristics have to be taken into account.

Weather and environmental conditions also influence the spread of radioactivity. The speed and direction of winds, rain, and humidity affect the impact and coping procedures.

[52] John Deutch, "The Nuclear Threat," in Yonah Alexander and Milton Hoenig, eds., *Super Terrorism: Biological, Chemical, and Nuclear* (Ardsley, NY: Transnational Publishers, 2002), pp. 67-74.

The most crucial factor is the capacity of the local authorities to cope with the emergency. This management capacity involves several key issues such as a correct assessment of the situation by detecting the magnitude and extent of radiological contamination without unnecessary delay. This implies that the equipment to detect radiation and decontaminate the affected area and trained personnel are readily available. Are the required emergency medical and first-aid facilities available? Are trained responders available to carry out rescue and relief operations? The local authorities should give proper guidance and instruction for coping with the situation – should people evacuate or take shelter inside? Furthermore, interagency cooperation amongst various departments and agencies of the government and levels of administration will also have implications for the management of the situation. Effective and timely handling of key issues is needed to mitigate the impact to populated areas.

It is also important that the administration and the media interact closely to avert the broadcast of misinformation and rumors. Radio, television, and the press can extend invaluable service by informing people about what they should or should not do. In case of an evacuation or the adoption of other measures at the mass level, the media can pass on the necessary instructions for orderly management.

3.1. Political Impact

Nuclear terrorism could produce far-reaching political consequences for a society and especially its government. If the post-nuclear terrorism situation is not dealt with by the administration in a swift and effective manner, it could cause such a social and political upheaval that parts of the country may slide into anarchy, threatening the socio-political order.

If the administration does not take effective control of the situation at the earliest, the fear of radiation exposure could cause panic in the populace. Even a rumor of release of radioactivity can have a devastating impact. In the absence of any guidelines for coping with the situation, people may start fleeing the area, creating a host of problems. An unplanned evacuation would add to the hardships due to traffic jams, road accidents, and disruption of the transport system. Private transporters may extort exorbitant fares for moving people to safer places. Those unable to pay such fares may set off on foot, creating additional traffic problems. An unplanned mass migration could cause shortages of food, water, medicine, and fuel for transport. Frustration and anger caused by these difficulties could lead to violence. Criminals may take advantage of the panic and chaos and may engage in extortion or looting.

The political fallout of a radiological attack depends on how the government handles the situation. Major issues include the following:

1. Was the government able to identify and apprehend those responsible for nuclear terrorism?

2. Why did the government and the local administration not adopt precautionary safety and security measures to preempt nuclear terrorism? Was the government guilty of negligence?

3. How did the government respond to the emergency? Was it able to mobilize its resources quickly for extending medical treatment and first-aid facilities to the injured?

4. Did the government undertake the rescue and evacuation work in an orderly and swift manner?

5. Did the government provide effective strategies for the cleanup of the affected area and for rehabilitation of affected and displaced people? Did it offer material support (i.e., grants and loans) to help people cope with financial losses and to restart their businesses? What steps did the authorities take to avert such disasters in the future?

6. Did the government handle the situation in a transparent manner and maintain an effective liaison with the media and the leaders of the community? Was the government responsive to suggestions and complaints about the handling of the situation?

The government's failure to satisfy the people on these issues can "cause the citizenry to lose confidence in the government."[53] The affected people and their sympathizers may engage in anti-government agitation and resort to violence. The opposition political parties might be willing to take advantage of such a situation by lashing out at the government for neglecting the people or for corruption and mismanagement of relief and rescue operations. They could press for the resignation of the government or create agitation. The media could also highlight the hardships faced by the people and censure the government for any perceived lack of ability to cope with the challenges posed by nuclear terrorism.

A perception of the government's failure to cope with the consequences of nuclear terrorism may exacerbate existing social, ethnic, linguistic, and regional cleavages. These tensions could lead to inter-ethnic or inter-communal riots, especially if a minority community is somehow viewed as being linked with nuclear terrorism. In case of agitation, the government may attempt to deflect this by targeting weaker sections of society, especially minority groups. These developments could destabilize the polity and jeopardize the future of the government.

Nuclear terrorism has implications for inter-state relations. If the ruling elite of the state that is a victim of nuclear terrorism somehow links nuclear terrorism with another state and holds it responsible for the incident, bilateral relations will be marred. This is more likely to be the case if the two states happen to be neighbors and have a history of acrimonious relations. They may trade charges and countercharges, followed by a downgrading of their diplomatic ties and a resort to coercive diplomacy, if not armed conflict. A target state may accuse a particular or an unnamed foreign power of sponsoring nuclear terrorism in order to deflect domestic criticism.

How a state copes with nuclear terrorism or deals with terrorist groups will draw the close attention of other states amid the growing global concern about terrorism and transnational linkages of terrorist groups. If a state is perceived to be unable or unwilling to take effective measures to check terrorism, its relations with other countries may be adversely affected. Other states will seek information on these groups and may pressure the state concerned to take definite and firm action for containing terrorism.

[53] Fakenrath, Newman, and Thayer, *America's Achilles Heel*, p. 7.

3.2. Economic Impact

A radiological attack can cause a chain of economic impacts. All business and commercial activity would shut down as the affected area is cordoned off soon after the explosion of a dirty bomb. If it is determined that the quantity of radioactivity released is dangerous for humans, commercial activities in the affected area would face more serious and long-term economic hardships. Business activity would be disrupted for a considerably long time. This does not merely mean a loss of jobs for the people working in the affected area; the people and the establishments engaged in manufacturing of goods for supply to the business outlets in the affected areas would also be affected. Furthermore, most goods and products left in the affected area may also be contaminated, especially food in stores, restaurants, and home kitchens. Their suitability for human consumption would have to be checked.

Real estate would be adversely affected as large areas may become uninhabitable for a long period. New investment would avoid the area, which would have negative implications for the future economic prospects of the area. The stock market would also be hit hard by nuclear terrorism. Share values would tumble and new investment would dry up, at least for some time.

Businesses and commercial activities such as banking services would be relocated or shifted to branches. However, a large number of business and commercial concerns would not be able to resume their activities quickly. Medium- and small-level businesses could go out of business. Transportation and related services, caterers, restaurants, and street vendors would also be adversely affected. Nuclear terrorism could thus cause economic dislocation to many people.

A radiological attack also carries negative implications for insurance and reinsurance businesses. Insurance companies may be inundated with claims for human and material losses caused by the radiological attack. Insurance companies may be reluctant to seek new business, or may raise insurance premiums for the affected area. In the United States, total payments for insurance claims from September 11 are expected to range between $40 and $50 billion. In the post-September 11 period, all insurance companies are excluding or limiting coverage for terrorist acts from new policies. If terrorism insurance is offered, the premium is high,[54] which adversely affects business and commercial activities.

Even if the affected area were declared safe for human beings, it would suffer from a crisis of public confidence. Many people, especially those whose relatives and close friends died or suffered from serious illness, may not want to return to the area. Tourists and other visitors may continue to stay away from the area. The government would have to make special efforts to convince people, especially business and commercial interests, that the area is now safe. It may have to offer incentives to those who return to the area to live and especially to initiate economic activity.

Nuclear terrorism may damage the affected country's exports. Many countries may be reluctant to purchase processed food and agricultural products from that country, fearing that

[54] For details, see *Economic Perspectives on Terrorism Insurance*, Report of the Joint Economic Committee, US Congress, Washington, D.C., May 2002. See also Abraham McLaughlin, "Insurance Rates Spiral Up in Wake of September 11," *Christian Science Monitor*, April 8, 2002.

these may be contaminated by radiation. International trade (imports and exports) may also be affected by a greater emphasis on security. Customs authorities may impose strict rules for inspection of goods moving across international boundaries. Conceivably, all incoming goods would be subjected to strict inspections, slowing down the movement of goods. A large number of containers piled up at the New York port in the immediate aftermath of September 11 because the US Customs Service tightened controls. Later, it launched several new programs to increase anti-terrorism capability. One such program calls upon US importers to adopt additional security measures in return for expedited clearance of their goods by the Customs Service at the port of entry.[55] Similarly, as additional controls are imposed on immigration, the movement of people will be restricted. Slowing down the movement of goods, services, and people has negative implications for the global economy.

3.3. Health Impact

A radiological terrorist attack would produce short- and long-term health-related consequences, depending on the nature and quantity of the radiation released. Death and injury from the explosion would be immediate. Radiation sickness or illnesses such as cancer may occur, depending on the nature and amount of radiation and the duration of exposure.

Intense gamma rays cause tissue damage and acute radiation poisoning. Low levels of gamma rays can cause genetic mutations leading to cancer. Alpha particles emitted by plutonium and americium cause health hazards, especially if these are inhaled, causing damage to lung tissue.[56] Long-term consequences are equally alarming. Inhaled plutonium can cause lung, bone, thyroid, and liver cancer, which may surface after some time, perhaps after years. In certain cases, the effects of exposure to radiation may not appear for several decades. People may continue to suffer from the consequences for a very long time after the exposure. Health problems will continue to afflict the affected population, often surfacing years after the incident.[57] Children born to people suffering from radiation exposure may inherit genetic effects, which need to be distinguished from the somatic effects suffered by exposed persons.[58]

Radiation health consequences can be reduced if first aid and medical assistance are readily available after a nuclear terrorist incident has occurred. The people directly exposed to radiation need to be provided with emergency medical assistance and shifted to hospitals situated in safer areas. Specialized training is needed to cope with an emergency caused by a radiological attack or incident. Hospitals must be ready to deal with a large number of patients. This calls for the availability of the required medicine, equipment, trained doctors, and support staff. Personnel engaged in first aid, transportation, and subsequent care of patients need to be protected from radiation exposure. If protective gear were not available, fewer people would be willing to undertake medical assistance and rescue operations.

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[55] Edward Walsh, "Changing Customs: Can Free Trade Flourish with Focus on Terrorism?" *Washington Post*, July 26, 2002.

[56] Testimony of Dr. Henry Kelly, President Federation of American Scientists, before the Senate Committee on Foreign Relations, March 6, 2002. http://www.fas.org/ssp/docs/030602-kellytestimony.htm

[57] Merril Eisenbud and Thomas Gessell, *Environmental Radioactivity from Natural, Industrial and Military Sources*, Fourth Edition (San Diego: Academic Press, 1997), p. 15.

[58] For a discussion of the somatic and genetic effects, see *Ibid*., pp. 15, 22-38.

In addition to caring for the injured and sick, the remainder of the affected populace would need help, i.e., moving out of the affected areas and receiving precautionary medical and safety guidance. For example, to offer limited protection against radioactive iodine exposure, potassium iodide pills may be made available.

3.4. Psychological Impact

Terrorism has powerful psychological effects. It causes acute fear and confusion at the individual and societal levels, thereby undermining the collective morale and individual self-confidence that keep the social fabric intact. A major act of terrorism could thus threaten social and political stability. Terrorism involving nuclear, chemical, or biological agents could result in great panic because these agents cause both immediate and long-term damage to human life and the environment.

The psychological impact of a dirty bomb exceeds the radius of deaths and injuries. "It is a weapon of terror, fear and panic and disruption rather than one of mass destruction."[59] Deaths and injuries may be confined to the immediate vicinity of the explosion, but fear could cause panic in a very large area. For ordinary people, fears of the unknown and the unseen cause much personal insecurity. A rumor of an airborne radioactive release that poses serious health hazards would be enough to create panic, causing many people to flee the area. Commenting on the psychological impact of radiological terrorism, John W. Poston, Sr., says, "You can think of all kinds of things, people panicking, killing each other in automobiles, arguing over who has the right of way, crazy things that would have nothing to do with radioactivity but would be caused by psychological effects."[60]

Fear of being contaminated can impose psychological pressures on a large number of people. Some may face a nervous breakdown or develop symptoms of perpetual anxiety and insomnia. The stress caused by the spread of radiation and the subsequent evacuation could increase the incidence of heart attack and related ailments. These problems might persist long after the incident.

The trauma would be severe for the relatives and close friends of those killed or seriously injured in the accident. The adverse impact may be more acute for the elderly, especially those already suffering from serious health problems. If proper attention is not given to them, they could develop feelings of abandonment and helplessness.

Heavy financial losses through the loss of property as well as the disruption of regular income can produce serious stress. Coupled with the death or serious illness of members of the family, stress may become unbearable, alienating individuals from society. Children may develop lifelong insecurities and deep fears. A large number of people may need varying degrees of consultation and care from mental health professionals and psychologists.

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[59] Don Oldenburg, "How Bad Would 'Dirty' Bomb Be?," *Washington Post*, June 13, 2002. See also Morten Bremer Maerli, "The Threat of Nuclear Terrorism: Nuclear Weapons or Other Nuclear Explosive Devices," paper presented at the Symposium on International Safeguards: Verification and Nuclear Material Security, Vienna, October 29–November 1, 2001. http://www.iaea.org/worldatom/Press/Focus/Nuclear_Terrorism/maerli.pdf

[60] Matthew L. Wald, "Fear Itself is the Main Threat of a 'Dirty' Bomb," *New York Times*, June 11, 2002.

4. National Measures to Combat the Threat of Nuclear Terrorism

The growing concern about nuclear terrorism has focused attention on the security of nuclear weapons, plutonium, and weapons-grade uranium, lower-grade radioactive materials, and nuclear installations. In the past, the primary focus was on unauthorized and accidental use of nuclear weapons, accidental release of and exposure to radiation, and safety of the personnel handling radioactive materials. These concerns continue to be important today but, in the post-September 11 period, the issue of combating nuclear terrorism has acquired much salience.

The underlying consideration is that individual states and the international community should adopt security measures to ensure terrorists cannot threaten the security of a nuclear facility and/or obtain nuclear weapons, weapons-grade fissile materials, or lower-grade radioactive materials.

Nuclear weapon states adopt strict measures for the security of nuclear weapons and weapons-grade fissile materials. The same may not always be true of non-weapons-grade radioactive materials that are used by civilian institutions.

Radioactive materials of varying strength and quantity are used in universities, medical and health institutions, food processing plants, oil drilling processes, and other commercial enterprises. The quantities of radioactive substances used by the civilian sectors may range from tiny traces to larger amounts sufficient to make a dirty bomb. It is difficult for a state to track all such equipment and materials located in its territory. The US Nuclear Regulatory Commission has reported that US companies lost track of nearly 1,500 radioactive pieces of equipment since 1986, and more than half were never recovered. An environmental agency has claimed that up to 30,000 radioactive parts have been thrown away or abandoned by private companies and institutions.[61] According to IAEA estimates, more than 1,306 kilograms of HEU existed in research reactors in 27 countries in August 2000. The estimates for civilian plutonium were 180,000 kilograms in 12 countries.[62]

Many experts have expressed concern about the security of post-Soviet nuclear weapons and materials. The media have reported smuggling of fissile materials from Russia, Ukraine, Belarus, and Kazakhstan and the availability of radioactive materials from these states on the black market. Fear has been expressed about the possibility of unemployed or poorly paid ex-Soviet nuclear scientists selling their skills to the highest bidder or becoming involved in the smuggling of nuclear material. The IAEA has reported 175 incidents of smuggling of enriched uranium from ex-Soviet territories since 1993. Other estimates cite a higher figure.[63]

Some analysts advocate disarmament and arms control as the best safeguards against nuclear terrorism. They argue that the international community should work toward elimination

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[61] Barton Gellman, "Arrest Shifts Focus to US Sources of Atomic Isotopes," *Washington Post*, June 11, 2002.
[62] George Bunn and Fritz Steinhausler, "Guarding Nuclear Reactors and Material From Terrorists and Thieves," *Arms Control Today* (October 2001). http://www.armscontrol.org/act/2001_10/bunnoct01.asp
[63] *Loose Nukes: Terrorism Questions and Answers*, New York: Council of Foreign Relations, http://www.cfrterrorism.org/weapons/loosenukes.html; Karl F. Inderfurth, "Leftovers from an Old War," *New York Times*, November 7, 2001; Scott Peterson, "Uzbeks Block Central Asia's Nuclear Corridor," *Christian Science Monitor*, August 7, 2002.

of nuclear weapons and fissile materials in order to reduce the threat of nuclear terrorism. This idealistic solution is not likely to be realized. However, arms control and especially nuclear nonproliferation can contribute to reducing the threat of nuclear terrorism. If nuclear materials and technologies proliferate, terrorists are likely to get more opportunities to obtain weapons or fissile materials.

Nuclear arms control and nonproliferation of nuclear materials and technologies are relevant to limiting nuclear terrorism. An effective check against nuclear terrorism requires that states adopt adequate means for the protection of nuclear weapons, weapons-grade fissile materials, other radioactive materials, and nuclear installations. These measures involve technology, human involvement, methods and procedures, and regular review and upgrading of these measures and techniques. The major methods for combating nuclear terrorism are discussed below.

4.1. Detection of Radiological Weapons and Materials

The use of modern technology (such as sensors) for the detection of nuclear weapons and radioactive materials enables internal and border security personnel to interdict unauthorized movement of weapons and materials within a country and across international borders. This discourages smuggling of radiological materials and deters terrorist groups from transporting such materials or a dirty bomb from one place to another.

A detection system faces three major problems. First, terrorists can be expected to adopt some measures, e.g., use of some shielding, to transport a radiological weapon to make detection difficult, if not impossible. Second, some background radiation always exists. If a shielded radiation source does not emit radiation that stands out above the background radiation, it may not be detected. Third, strict surveillance for detection of radioactive materials may slow down the movement of goods and people. Furthermore, there may also be false alarms by radiation detectors. If every container and bag is carefully checked at ports of entry or at entry points to major cities, serious problems and delays will ensue. Therefore, a balance is needed between the imperatives of security measures against nuclear terrorism and the need for quick movement of goods and people. The government should maintain regular consultations with business concerns and transporters on these issues and the security requirements and the changes therein should be clearly notified so that businesses and travelers do not face serious hardships.

4.2. Immigration and Border Controls

A number of terrorist groups have become transnational. They function in several countries or maintain contacts with their counterparts in different countries. It is therefore important to track their transnational activities and disrupt their connections, transactions, and movements.

This requires stricter criteria for issuance of visas and careful checks at points of entry/exit of a country. Similarly, more effective measures can be adopted to check illegal movement of goods and personnel across land borders and coastlines. Surveillance cameras, motion sensors, and trained personnel are needed in border areas used for illegal trans-border

activities. Surveillance of air space in border areas with the help of radars and human monitors is also important to check unauthorized movement of goods and people. The precise nature of border controls and monitoring will depend on the particular topographical and environmental conditions of the area and on threat assessment.

An official US report (December 2001) has argued that the "issues of immigration enforcement and border security" are "especially important in developing a national strategy for combating terrorism."[64] Effective immigration controls and monitoring and surveillance of international boundaries, including coastline and airspace, can discourage the movement of terrorists and radioactive materials and other dangerous substances or contraband. These goals can be facilitated if the border security authorities of neighboring states cooperate with each other for interdicting the unauthorized movement of goods and people across international boundaries.

4.3. Control and Protection of Nuclear Weapons

Nuclear weapons require the maximum possible security against theft or unauthorized use. This calls for a multilayered security system such that if one element malfunctions or is somehow breached, other security mechanisms can foil the attempt.

Barriers such as fences, vehicle traps, and pop-up crash barriers prevent access to nuclear weapons storage areas. These measures are augmented by the presence of security guards, surveillance cameras, motion detection sensors, and a system of identification for authorized persons and vehicles. Admission to high-security areas is restricted to a small number of authorized persons.

A major consideration of installing physical obstacles is to delay the entry of unauthorized persons so that, when intruders are detected, response force personnel can be activated to counteract the situation.

Security features can be built into nuclear weapons to protect them from unauthorized use or accidental detonation. The United States has developed PALs to preclude the unauthorized arming of a nuclear weapon. Unless certain specified procedures are observed, nuclear warheads do not become operational. The PAL system ensures that if terrorists somehow steal a nuclear weapon, it cannot be detonated. However, not all nuclear weapons states have a PAL system to protect their nuclear weapons.

Another option is to store nuclear weapons in unassembled form. Components are stored at different locations. This strategy precludes the chances of a fully operational nuclear weapon falling into the hands of terrorists. However, adequate measures must safeguard the nuclear weapon components hidden in different locations. An accounting system for nuclear warheads and their components is also essential.

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[64] *Third Annual Report to the President and the Congress of the Advisory Panel to Assess Domestic Response Capabilities for Terrorism Involving Weapons of Mass Destruction*, December 2001, p. 35. http://www.rand.org/terrpanel

The security of nuclear weapons also depends on an effective Command, Control, and Communication (C3) system. This must be designed and managed to cope with all possible threats to the security of nuclear weapons, including their unauthorized and accidental use. A secure and effective C3 system with clear lines of authority and communication can play a key role in keeping nuclear weapons safe and secure.

4.4. Physical Protection of Nuclear Materials

The protection of nuclear materials has always been a matter of concern for the international community but implementation relies on national measures. The IAEA advises its member states on the protection of nuclear facilities and nuclear materials through publications[65] and visits to nuclear facilities, at the member states' invitation. The IAEA emphasizes that an individual state's physical protection of nuclear materials should ensure two inter-related goals:

1. To establish conditions which would minimize the possibilities for unauthorized removal of nuclear material and/or for sabotage; and

2. To provide information and technical assistance in support of rapid and comprehensive measures by the State to locate and recover missing nuclear material and to cooperate with safety authorities in minimizing the radiological consequences of sabotage.

The IAEA has proposed a number of new measures, including border monitoring, to strengthen the security of nuclear materials. In the immediate aftermath of September 11 and in March 2002, its Board of Governors approved an Action Plan designed to help states in their efforts to enhance the physical protection of nuclear and other radioactive materials.[66]

One way to prevent terrorists from acquiring the means to create a dirty bomb is to strengthen the protection of radioactive materials. Protection measures include fences, road barriers, guards, and entry control systems, as well as electronic and video systems to detect and assess intrusions. A CMC study discusses a three-element remote monitoring system for strengthening security. These elements are sensors to measure observable quantities, communication links, and data storage and analysis systems.[67] The underlying consideration is to make it impossible for an unauthorized person to access radioactive materials and remove these from storage without detection.

In addition to video monitoring and detection sensors, all persons and packages, including personal bags, should be thoroughly searched on entry and exit. Preferably, no personal belongings should be allowed beyond certain points in the high-security area. Access

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[65] *The Physical Protection of Nuclear Material and Nuclear Facilities*, item 3.1, IAEA Information Circular 225, Revision 4 (Corrected). http://www.iaea.org/worldatom/program/protection/inf225rev4/rev4_content.html

[66] IAEA Press Release: *Calculating the New Global Nuclear Terrorism Threat*, November 1, 2001, http://www.iaea.org/worldatom/Press/P_release/2002/nt_pressrelease.shtml; IAEA Press Release: *Board of Governors Approve IAEA Action Plan to Combat Nuclear Terrorism*, PR2002/04, http://www.iaea.org/worldatom/Press/P_release/2002/prn0204.shtml

[67] John N. Olsen and Charles D. Harmon, *Technology Development for Nuclear Transparency Applications.* http://www.cmc.sandia.gov/Links/about/papers/jolsenTransApp/JNCpaper.htm

to high-security storage areas should be limited to a small number of people whose trustworthiness is fully established and whose jobs require their entry.

Any program for the protection and security of nuclear materials would be incomplete without strategies for recovering missing nuclear materials. If some radioactive material is stolen, misplaced, or not accounted for, all possible physical and technical measures should be adopted to track it down without causing unnecessary alarm about radiation hazards.

4.5. Nuclear Installation Security

A terrorist attack on a nuclear plant cannot easily succeed in causing the dispersal of radiation. These plants were built to withstand earthquakes, cyclones, hurricanes, small plane crashes, or even bomb attacks. The containment walls around a nuclear reactor are several feet thick and equipped with a robust security system[68] and safety mechanisms. Much depends on the magnitude of the attack and the extent to which security has been breached. If the building containing a nuclear reactor and its safety systems are damaged, serious consequences could ensue.

The security system of nuclear facilities "deters, detects and denies access"[69] to unauthorized persons. Two basic frameworks for the security of nuclear plants are graded security and power block security. Under the graded security system, sophisticated security arrangements start from the outer perimeters, and these become tougher as the intruder approaches the buildings and assets being protected. These measures include strong perimeter fences, barriers, and roadblocks as well as security guards, reinforced by a backup or response force, to intercept intruders. Electronic surveillance and video cameras are used to detect motion. The building housing a nuclear reactor or a storage site has its own security system involving secure locks, vaults, steel doors, concrete walls, a surveillance system, identification devices, and security guards. Under the power block security system, the outer perimeter security is not strict. The outer fences may be only to keep animals away or to clearly demarcate the area. However, security arrangements are very robust around and in the building and storage site, similar to those adopted under the graded security system, in order to deter and deny access to unauthorized personnel.[70]

As concern for the security of nuclear plants has increased in the post-September 11 period, a combination of the two methods is likely to be useful. A combination of modern technology, procedures, and trained personnel is required to strengthen the perimeter and building security. Special attention should be given to the security equipment, systems, or

[68] Matthew Bunn and George Bunn, "Strengthening Nuclear Security Against Post-September 11 Threats of Theft and Sabotage," *Journal of Nuclear Materials Management*, 30, 3 (Spring 2002), pp. 48-60.
[69] Herbert Dixon, *Physical Security of Nuclear Facilities*, Nuclear Control Institute, p. 194. http://www.nci.org/pdf/nt-book/Dixon.pdf
[70] Dixon, *Physical Security of Nuclear Facilities*.

devices in the vital areas. If the staff finds evidence of tampering, this needs to be reported and rectified.[71]

Many countries also adopt a carefully devised air defense system for nuclear installations. The airspace on or around nuclear installations and plants is designated as a no-fly zone and is closely monitored. In case of emergency or some perceived threat, anti-aircraft and anti-missile armor is installed to protect the installations from a possible air attack.

4.6. Personnel Reliability

Despite the sophistication of the technology used for ensuring the security of nuclear weapons, nuclear materials, and nuclear facilities, the reliability of personnel managing security arrangements is extremely important. Personnel reliability has two aspects. One, persons dealing with nuclear and other radioactive materials as well as security forces employed at nuclear facilities must be qualified and trained. Strict standards of professional competence must be adhered to. Two, these people must be highly trustworthy and reliable for handling sensitive information. Their commitment to their profession and loyalty to the organization must be fully established so that they do not compromise the confidentiality and security of their assignments.

Personnel reliability is one measure used to counter insider threats of radiological sabotage. A frustrated or an alienated employee could resort to sabotage or may not fully carry out an assigned task, thereby compromising security and safeguard procedures, which may produce hazardous consequences. A more dangerous situation could develop if an insider colludes with an outsider to subvert the security system. An alienated insider can play a passive or active role in undermining security safeguards. A passive insider could provide sensitive information to an outsider. Active insiders are defined as those who not only provide information, but also help outsiders enter the facility, and might participate in a violent attack. An insider may be motivated by money, grievances against management, ideological beliefs, or suffer from mental instability.

The reliability and trustworthiness of persons in sensitive positions are established and verified periodically through a continuous process that starts from the time of recruitment and continues throughout the service period. The following strategies can help to ensure personnel reliability.[72]

1. A thorough background check is required to verify the individual's identity and to investigate the individual's credit history, criminal history, reputation, and character.

2. A psychological screening will facilitate personality assessment against the backdrop of the data secured under item 1.

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[71] INFCIRC/225/Rev.4 (Corrected), Section 7, "Requirements for Physical Protection Against Sabotage of Nuclear Facilities and Nuclear Material During Use and Storage" http://www.iaea.or.at/worldatom/program/protection/inf225rev4/rev4_sabotage.html

[72] *Report of the International Task Force on Prevention of Nuclear Terrorism*, Washington, D.C.: Nuclear Control Institute, 1986, p. 10. See also letter entitled "Protection Against Radiological Sabotage by Insider(s)" by the Union of Concerned Scientists to US Nuclear Regulatory Commission, Washington, D.C., November 29, 2001. http://www.ucsusa.org/index.html

3. A detailed interview at the time of first employment or when a sensitive task is being assigned is also helpful in assessing the personal disposition of an individual.

4. A periodic review of job performance and interaction with co-workers is important. Annual job performance reports and periodic reviews of the career record, including improvement of academic and technical skills and other professional achievements, may be taken into account when assigning a person to highly sensitive positions.

The US Department of Defense (DoD) has established a Personnel Reliability Program (PRP) for persons performing duties relating to nuclear weapons.[73] The PRP emphasizes the initial as well as continuing evaluation of the personnel concerned. The qualifying standards of the PRP include physical competence, mental alertness, and technical proficiency. Other requirements include dependability in accepting responsibilities, effective performance, flexibility in adjusting to the changes in the work environment, capacity for social adjustment, emotional stability, an ability to exercise sound judgment in an adverse or emergency situation, and a positive attitude toward the assigned duty. Security clearance, medical fitness, and a personal interview are also integral to the PRP.

The PRP specifies conditions that may disqualify or decertify a person from holding nuclear weapons-related assignments, such as alcohol abuse or dependency, drug abuse, conviction of, or involvement in, a serious incident, an adverse medical—physical and mental—condition or serious progressive illness, lack of motivation, and suicide attempt or threat.[74]

In addition to personnel vetting, security measures include use of the two-person rule and rotation of assignments. Periodic monitoring of a person's after-work activities may be desirable.

4.7. Material Control and Accounting

An effective nuclear material control and accounting system tracks the quality and quantity of nuclear materials and their authorized movement, which helps to detect if there has been any unauthorized removal of such materials. Nuclear material control implies the adoption of "control and monitoring measures" to prevent loss. It also involves taking physical inventory of the materials.[75] Regular accounting makes it possible to detect if nuclear materials have been diverted.

State parties to a safeguards agreement with the IAEA are required to use material control and accounting as a strategy for keeping nuclear materials safe and secure. The IAEA requires that "a state that is operating nuclear facilities is able to account for its nuclear

[73] *Nuclear Weapon Personnel Reliability Program (PRP) Regulations*, DoD5210.42-R, Washington, D.C.: Department of Defense, January 8, 2001.
[74] Nuclear Weapons Personnel Reliability Program (PRP) Regulations.
[75] *Material Control and Accounting*, US Nuclear Regulatory Commission. http://www.nrc.gov/what-we-do/safeguards/mca.html

material."[76] However, the actual accounting, i.e., bookkeeping and stocktaking of nuclear materials, is done by a state itself subject to independent verification by the IAEA. It may be desirable for a state to associate the IAEA with the accounting process or seek its advice for effective accounting to assure the international community that nuclear materials are under its firm control.

4.8. Transportation

Nuclear materials are vulnerable to attempts at unauthorized removal or sabotage during transportation from one nuclear facility/storage to another facility. States take extraordinary precautions in transporting nuclear weapons, weapons-grade fissile material, and other radioactive materials. All aspects of transportation are considered, including the selection of route, mode of transportation, quality of the containers carrying the materials, security arrangements, and emergency response. Details are kept confidential.

Nuclear materials are transported in secure containers that are placed in secure trucks or railway compartments capable of withstanding terrorist attacks. Trained, armed guards travel with the transport and reinforcements are available. Mobile patrols or helicopters guard the route. Constant communication is maintained between the transport vehicle, escort or security personnel, and the transportation operation control center. When the consignment reaches its destination, the security of the contents is verified.[77] Similarly, a high-security procedure is used when shipments are sent from one state to another. When Japan shipped defective nuclear fuel to its British supplier in July 2002, the two cargo ships had an elaborate security system.[78] National navies may escort such shipments.

4.9. Radioactive Waste

Nuclear energy applications produce waste, which is radioactive to varying degrees. It has to be disposed of in a manner that does not cause any threat to human health and the environment. The IAEA describes radioactive waste as "any material that contains a concentration of radionuclides greater than those deemed safe by national authorities and for which no use is foreseen."[79]

Depending on its radioactive content, the IAEA classifies radioactive waste into the following categories: exempt waste, low- and intermediate-level waste, and high-level waste. The exempt category of nuclear waste has negligible radioactive content and it can be disposed of easily. Low- and intermediate-level waste contains enough radioactivity to cause some health

[76] Ed Lyman, "Role of Nuclear Material Accounting and Control in the NPT," paper presented at the Conference on Nuclear Dangers and the State of Security Treaties, Institute for Energy and Environment Research, New York, April 9, 2002, pp. 2-3. http://www.ieer.org/latest/npt02el.html
[77] Dixon, *Physical Security of Nuclear Facilities*.
[78] Howard French, "Japanese Shipment of Nuclear Fuel Raises Security Fears," *New York Times*, July 25, 2002.
[79] *Managing Radioactive Waste*, IAEA Fact Sheet. http://www.iaea.org/worldatom/Peridocals/Factsheets/English/manradwa.html

and environmental problems. Depending on its radioactive content, necessary safeguards have to be adopted. High-level nuclear waste requires cautious handling for a longer duration.[80]

A nuclear waste storage and disposal system can be a potential target of terrorists. A successful terrorist attack on a nuclear waste storage area could cause radiological contamination. The intermediate-level and high-level waste could be used for making dirty bombs. Waste may be stored initially at the nuclear facility and later moved to a permanent storage and disposal area. These sites have to be completely secure against all unauthorized entries.

Current long-term disposal of radioactive waste is accomplished by burying the waste in secure containers in a remote area. These storage areas are monitored to ensure that there is no radiation leakage from the stored waste. Arrangements have to be made for perimeter security of the storage area to check unauthorized entry. In the past, there have been instances of nuclear waste becoming "abandoned" as nobody is prepared to look after it. There have also been instances of unsafe disposal of nuclear waste.[81] Given the heightened sensitivity about terrorism in the post-September 11 period, greater attention has been paid to the safe disposal of nuclear waste because its theft or a terrorist attack on a waste site could cause serious consequences.

4.10. Intelligence Gathering

The goal of deterring, detecting, and thwarting a terrorist attack on a nuclear facility or the theft of nuclear materials cannot be achieved without intelligence gathering. Intelligence agencies must quietly monitor activities in and around nuclear facilities in order to detect any extraordinary activities, including exceptional movement of people or goods. Periodic surveillance of the off-duty activities of those in highly sensitive positions is advisable. Intelligence services should track highly politicized and terrorist groups—their leadership, goals, strategies, and linkages. The crucial issue is the assessment of their capabilities and intentions to engage in nuclear terrorism. Do the members of these groups try to obtain information on nuclear installations and nuclear technology? Do they try to develop interaction with people associated with the nuclear program? Are these groups trying to infiltrate nuclear installations by recruiting the staff, scientists, and technical personnel associated with the nuclear program? Intelligence agencies can also play an important role in enforcement of the PRP by collecting information for pre-service background checks.

Given the transnational character of terrorist groups, states (especially neighboring states) should share information on threats of nuclear terrorism and the terrorist groups that are likely to engage in such activities. Active cooperation among various national intelligence services is likely to improve their capacity to combat nuclear terrorism. Many terrorist groups now use modern technology for communication and interaction. They often use mobile phones, the internet, e-mail, and fax.

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[80] *Managing Radioactive Waste.*

[81] Joel O. Lubenau and Daniel J. Strom, "Safety and Security of Radiation Sources in the Aftermath of 11 September 2001," *Health Physics*, 38, 2 (August 2002), pp. 155-164.

5. International Efforts to Combat the Threat of Nuclear Terrorism

In a world characterized by rapidly increasing communication and the ever-expanding movement of people and goods, terrorist threats transcend national boundaries. While a specific nuclear terrorist threat may be aimed at a specific country, the terrorist group may choose to target another country later. The sources of terrorism and the activities of terrorist groups often span national frontiers, and measures to avert the threat must be international in scope to be effective. The community of states as a whole has a common stake in cooperating to suppress nuclear terrorism. Irrespective of their differences, all states share an interest in ensuring that non-state actors do not gain access to nuclear technology and materials for malicious purposes. Cooperation can be bilateral or multilateral. Because of its technological and financial advantages, the United States has played a substantial role in curbing the scope of nuclear terrorism.

5.1. Bilateral Cooperation: The United States and Russia

An example of how the threat of nuclear terrorism can be curbed through bilateral agreements is discussed in this section.

Following the end of the Cold War, the process of downsizing and reorganizing the large and unwieldy nuclear infrastructure of the Soviet Union was initiated by the United States. The ongoing Cooperative Threat Reduction (CTR) program has supported projects in Russia, Belarus, Kazakhstan, and Ukraine.[82] Apart from overseeing the transfer of the nuclear assets of the latter three to Russia, the nuclear component of the CTR program has provided the following ways to prevent nuclear losses of material and weapons:

- Securing Russian nuclear weapons against theft through accounting and tracking during the storage, transport, and dismantlement of warheads. Alarm systems and other security needs have been provided to numerous nuclear material storage sites. [83]

- Securing materials not directly used for nuclear weapons. Security upgrades have been provided for 53 facilities that stockpile nuclear materials.[84] The CTR program also provided training for Russian customs and border officials in the detection of smuggling. The Mayak Fissile Material Storage Facility, designed to store material from dismantled Russian weapons, is a joint venture of the United States and Russia.

- Providing job opportunities to thousands of underpaid or unemployed scientists and engineers, some of whom might sell their services or provide assistance to terrorist organizations. The International Science and Technology Center funds projects in fields such

[82] United States Department of Defense, "CTR: Cooperative Threat Reduction," http://www.defenselink.mil/pubs/ctr/ (downloaded August 1, 2002); Nuclear Threat Initiative, "Cooperative Threat Reduction" http://www.nti.org/f_wmd411/f1b5.html (downloaded August 1, 2002).
[83] Tom Z. Collina and Jon B. Wolfsthal, "Nuclear Terrorism and Warhead Control in Russia," *Arms Control Today*, 32, 3 (April 2002). http://www.armscontrol.org/act/2002_04/colwolfapril02.asp
[84] Collina and Wolfsthal, "Nuclear Terrorism and Warhead Control in Russia."

as environmental monitoring; immunology and pathology; nuclear safety and materials safeguarding; chemical process engineering; and power production.[85]

In addition, the United States joined with Russia and the IAEA to launch a tripartite working group on "Securing and Managing Security Sources" in June 2002. The group's tasks include the location, recovery, security, and recycling of "orphaned" radioactive sources, i.e., those sources that have not been under, or have slipped out of, state control.[86]

However, numerous obstacles to cooperation are inherent in inter-state politics. The recipient state is often reluctant to permit aid-givers access to all its facilities. An aid-giver may be tardy in extending wholehearted financial assistance. For instance, the United States devoted much attention after September 11 to emergency funding for domestic counterterrorism needs, but did not provide more money for the CTR program.[87] Alternatively, conflicting political objectives may impede cooperation. During FY 2002, the US State Department blocked funding for new CTR programs on the grounds that Russia had failed to comply with existing arms control treaties as required by the US Congress.[88]

Despite such hurdles, bilateral cooperation plays a major role in reducing the risk of nuclear terrorism. Depending on how priorities are framed, more such programs could be instituted for other countries. With respect to Russia alone, experts have put forward numerous proposals for more effective action. These include enhanced security measures for weapons and materials sites; the consolidation of material storage sites; replacement of HEU with low enriched uranium (LEU) in research and test reactors; conversion of HEU into LEU by a process of "blending down" to make it unusable (directly) for weapons production; conversion of excess plutonium stocks into non-weapons-usable forms; upgrading of material accounting systems, including "rapid accounting" to quickly identify and tag all nuclear weapons and materials; and use of "debt for nonproliferation" swaps (canceling debts in exchange for commitments to measures augmenting security).[89] The US Department of Energy (DOE) also operates the Radiation Emergency Assistance Center/Training Site (REAC/TS) designed for domestic and international crisis management in case of a radiation accident.[90] This institution, which

[85] International Science and Technology Center, "Resources for CIS Weapons Scientists." http://www.istc.ru/istc/website.nsf/fm/Resources+for+CIS (downloaded August 2, 2002).
[86] "Russia, USA & IAEA Join Forces," *IAEA Bulletin*, 44, 1 (2002), p. 3.
[87] Frank von Hippel, "Recommendations for Preventing Nuclear Terrorism," *FAS Public Interest Report*, 54, 6 (November–December 2001). http://www.fas.org/faspir/2001/v54n6/prevent.htm
[88] "Safeguarding Soviet Weapons," *Washington Post*, July 26, 2002.
[89] Matthew Bunn, *The Next Wave: Urgently Needed New Steps to Control Warheads and Fissile Material*, Carnegie Endowment for International Peace, Washington, D.C., April 2000; M. Bunn and G. Bunn, *Reducing the Threat of Nuclear Theft and Sabotage*, International Atomic Energy Agency, Vienna, October 30, 2001, Document No. IAEA-SM-367/4/08; Matthew Bunn, John P. Holdren, and Anthony Wier, *Securing Nuclear Weapons and Materials: Seven Steps for Immediate Action*, Belfer Center for Science and International Affairs, Harvard University, Cambridge, MA, May 2002; Robert L. Civiak, *Closing the Gaps: Securing High Enriched Uranium in the Former Soviet Union and Eastern Europe*, Federation of American Scientists, Washington, D.C., May 2002.
[90] United States Department of Energy, Radiation Emergency Assistance Center/Training Site. http://tis.eh.doe.gov/health/hservices/radiation_easst.html (downloaded August 2, 2002). See also "International Response," Oak Ridge Associated Universities, Oak Ridge, TN, February 21, 2002. http://www.orau.gov/reacts/intlresp.htm

collaborates with the IAEA and the World Health Organization (WHO), has the potential to play a significant role in the event an act of nuclear terrorism is committed anywhere in the world.

5.2. Multilateral Cooperation

There are numerous avenues of multilateral cooperation against the terrorist threat. The *global nonproliferation regime* maintains a system of control over materials and technologies through formal treaties such as the Treaty on the Non-Proliferation of Nuclear Weapons (NPT) as well as informal consultative processes such as the Nuclear Suppliers Group (NSG), supplemented by national laws regulating nuclear technologies and materials. However, the nonproliferation regime has a number of limitations: (1) It is primarily designed to prevent state proliferation rather than non-state proliferation; (2) It has not focused specifically on terrorism; and (3) It has not fully integrated the nuclear weapon states that are not NPT signatories (i.e., India, Israel, and Pakistan).

The United Nations

The *United Nations* (UN) has undertaken a series of actions to combat terrorism in general, including the creation of eleven conventions, notably the International Convention for the Suppression of Terrorist Bombings (1997) and the International Convention for the Suppression of the Financing of Terrorism (1999).[91] The UN has also created (1999) the Terrorism Prevention Branch (TPB) as an arm of the Vienna-based UN Office for Drug Control and Crime Prevention (ODCCP). The TPB coordinates its activities with the UN Center for International Crime Prevention (CICP), which is also based in Vienna, and which is responsible for – among other things – the prevention of transnational crime.[92] The TPB is mainly a research and data-gathering organization concerned with assisting in the investigation, prevention, and management of terrorist acts. In response to September 11, the UN Security Council approved the wide-ranging Resolution 1373, which created the Counter-Terrorism Committee (CTC) to monitor UN counterterrorism efforts.[93] The CTC has established a directory, which acts as a "one-stop shop" for states seeking help on legislation, on executive actions, and for details of training and assistance programs.[94]

While all of the above is indirectly relevant to nuclear terrorism, specific actions in this area have also been undertaken.[95] The Convention on the Physical Protection of Nuclear Material (CPPNM, in force since 1987) has two objectives: establishing the levels of protection

[91] United Nations, "United Nations Treaties Against International Terrorism." http://www.un.org/News/dh/latest/intreaterror.htm (downloaded August 2, 2002).
[92] United Nations, "UN Terrorism Prevention Branch (TPB)." http://www.undcp.org/terrorism.html (downloaded August 2, 2002).
[93] United Nations, "Security Committee Established Pursuant to Resolution 1373 (2001) Concerning Counter-Terrorism: Counter-Terrorism Committee." http://www.un.org/Docs/sc/committees/1373/ (downloaded August 2, 2002).
[94] United Nations, Presentation by Ambassador Greenstock, Chairman of the Counter-Terrorism Committee (CTC) at the Symposium: "Combating International Terrorism: The Contribution of the United Nations," Vienna, Austria, June 3-4, 2002. http://www.un.org/Docs/sc/committees/1373/ViennaNotes.htm
[95] Larry D. Johnson, "Treaties Against Nuclear Terrorism: The Global Legal Framework Can Make a Difference," *IAEA Bulletin*, 44, 1 (2002), pp. 4-6.

required for securing nuclear material used for peaceful purposes during international transportation, and punishing (through national laws) acts threatening nuclear material during international transportation or while in domestic storage. Though movement on the issue has been relatively slow (a review process began in 1999), there is a growing consensus that the Convention needs to be strengthened: that it should apply to all nuclear material, enumerate concrete measures to be adopted by states, and incorporate mechanisms for compliance. Besides, the Convention needs more members: as of July 2002 it had only 77.[96] The more comprehensive Draft Treaty for the Suppression of Acts of Nuclear Terrorism (under consideration with the Legal Committee of the General Assembly at the time of writing) also lacks strong binding requirements.[97]

The International Atomic Energy Agency

The *International Atomic Energy Agency* (IAEA) also plays a significant part in addressing nuclear terrorism-related concerns.[98] Its primary role – preventing state proliferation through a system of safeguards and inspections to audit the nuclear materials and facilities of non-weapon states that are NPT signatories – contributes indirectly to counterterrorism by preventing the loss of fissile material. Safeguards are in the process of upgrading by means of Additional Protocols. By June 2002, 62 states had signed these protocols.[99]

For the protection of nuclear materials, apart from the CPPNM (which was negotiated under the IAEA), the Agency has established, among other things, Physical Protection Objectives and Principles, and an International Physical Protection Advisory Service (IPPAS) to assist member states in reviewing and enhancing their physical protection systems for nuclear facilities and nuclear materials. The IAEA has also published a document, Information Circular 225, *The Physical Protection of Nuclear Materials and Nuclear Facilities*,[100] which provides recommendations for member states on international good practices.

The IAEA also facilitates the continuous improvement of national systems of material accounting and control, and measures to counter illegal trafficking in nuclear materials through technical assistance and information exchange.[101] The latter set of activities involves collaboration with other international agencies, such as the World Customs Organization and Interpol. In the event of a nuclear emergency, the IAEA has an emergency international response system for rapid communication and assistance under the Convention on Early Notification of a Nuclear Accident and the Convention on Assistance in the Case of a Nuclear Accident or Radiological

[96] "Nuclear Security Regime," *Worldatom FrontPage News*, International Atomic Energy Agency, Vienna, Austria, July 17, 2002. http://www.iaea.or.at/worldatom/Press/News/NucSecurRegime.shtml
[97] Johnson, "Treaties against Nuclear Terrorism," pp. 5-6.
[98] Anita Nilsson, "Security of Material: The Changing Context of the IAEA's Programme," *IAEA Bulletin*, 43, 4 (2001), pp. 12-15.
[99] "Safeguards Update," *Worldatom FrontPage News*, International Atomic Energy Agency, Vienna, Austria, June 20, 2002. http://www.iaea.or.at/worldatom/Press/News/sg_update062002.shtml
[100] *The Physical Protection of Nuclear Materials and Nuclear Facilities*, IAEA INFCIRC/225/Rev.4 (Corrected). http://www.iaea.org/worldatom/program/protection/inf225rev4/rev4_content.html
[101] "Measures to Strengthen International Co-operation in Nuclear Radiation, Transportation and Waste Safety," International Atomic Energy Agency, Vienna, Austria, August 6, 2001, Document No. GOV/2001/29-GC (45)/12.

Emergency.[102] While this system was originally devised for responding to accidents, it can be applied to emergencies that fall under the category of nuclear terrorism as well.

In response to September 11, the IAEA has begun a process of enhancing measures for safety and response by means of an Action Plan to combat the threat of nuclear terrorism.[103] Much remains to be done. Lawrence Scheinman has recommended enlarging the membership of the IAEA, extending the CPPNM to more comprehensive regulation of domestic practices, making the IAEA's recommendations binding, and expanding the IPPAS program.[104]

Regional Organizations

Some broad-based cooperation has also occurred at the level of *regional organizations*. Regional conventions on terrorism have been signed by the Organization of American States (1971), the Council of Europe (1977), the South Asian Association for Regional Cooperation (SAARC) (1987), the League of Arab States (1998), the Commonwealth of Independent States (1999), the Organization of the Islamic Conference (1999), and the Organization of African Unity (1999).[105] None of these encompass nuclear terrorism, but could be extended to that field. The same is the case with the 17-member Regional Cooperative Agreement for Research, Development and Training related to Nuclear Technology in Asia and the Pacific (RCA), which was established in 1972 and has recently been extended to 2007.[106] The potential for regional cooperation is yet to be fully tapped and could cover material control, safety, and environmental protection.[107]

5.3. Obstacles to Cooperation

An axiom of international politics states that cooperation among states is constrained by conflict of national interest. For various reasons, many states have not become members of the IAEA: as of April 2002, as many as 56 members of the UN had not joined the IAEA.[108] Also, many member states have yet to sign the Additional Protocols that require them to strengthen domestic nuclear safety measures. Financial commitments are limited by competing priorities. As a result, the IAEA suffers from a shortage of funds, with budgets stagnating since the mid-

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[102] "The IAEA Emergency Response System," *IAEA Fact Sheet*, International Atomic Energy Agency, Vienna, Austria. http://www.iaea.org/worldatom/Periodicals/Factsheets/English/emergency.html

[103] "IAEA Board of Governors Approves IAEA Action Plan to Combat Nuclear Terrorism," International Atomic Energy Agency, March 19, 2002. http://www.iaea.org/worldatom/Press/P_release/2002/prn0204.shtml

[104] Lawrence Scheinman, "Transcending Sovereignty in the Management & Control of Nuclear Material," *IAEA Bulletin*, 43, 4 (2001), pp. 33-38.

[105] United Nations Treaty Collection, "Conventions on Terrorism." http://untreaty.un.org/English/Terrorism.asp.

[106] "Nuclear Cooperation Extended in Asia and the Pacific," *Worldatom FrontPage News*, International Atomic Energy Agency, June 26, 2002. http://www.iaea.or.at/worldatom/Press/News/rca_exten.shtml

[107] John N. Olsen and Richard C. Lincoln, "Potential Nuclear Cooperative Measures for Safety, the Environment and Nonproliferation in East Asia," Cooperative Monitoring Center, Sandia National Laboratories, Albuquerque, NM, August 1997. http://www.cmc.sandia.gov/Links/about/papers/SAND97-1404c/index.html

[108] Calculated from "Member States of the IAEA," International Atomic Energy Agency, Vienna, Austria, http://www.iaea.org/worldatom/About/Profile/member.html (downloaded August 22, 2002); and "Member States," United Nations, http://www.un.org/members/index.html (downloaded August 22, 2002).

1980s.[109] The voluntary nature of contributions to the IAEA budget creates a "free-rider problem": many countries pay very little or not at all.[110] States are often reluctant to accept oversight by external agencies or other states. As of late 2001, as many as 50 NPT signatories had not entered into specific required safeguards agreements with the IAEA.[111] Three states with nuclear capability – India, Pakistan, and Israel – are not members of the NPT and, as a result, have not been properly accommodated into the nuclear suppliers' oligopoly.

The limitations of arms control also have an effect. So long as nuclear weapons continue to exist in large numbers, the availability of materials will be correspondingly high. The US-Russian Strategic Offensive Reductions Treaty (May 2002) permits the weapons "eliminated" by its lowered ceilings to be stored, which means Russia will retain a large nuclear weapons complex that could be vulnerable to terrorism. Finally, the extent to which global multilateral actions can pursue counterterrorist goals is limited not only by the difficulty of mobilizing a large number of states, but also by their often conflicting perceptions and interests. Notably, in spite of the prolonged deliberations of a committee dedicated to the task since 1996, the UN is still unable even to agree on a definition of "terrorism."[112] Clearly, considerable effort is still required for the building of a more effective global regime to counter the threat of nuclear terrorism.

[109] Pierre Goldschmidt, "Strengthened Safeguards: Meeting Present and Future Challenges," *IAEA Bulletin*, 43, 4 (2001), pp. 10-11.
[110] Scheinman, "Transcending Sovereignty in the Management & Control of Nuclear Material," p. 35.
[111] Scheinman, "Transcending Sovereignty in the Management & Control of Nuclear Material," p. 34.
[112] Peter Weiss, "International Law Related to Terrorism," paper presented at the Conference on Nuclear Dangers and the State of Security Treaties, Institute for Energy and Environmental Research (IEER), New York, NY, April 9, 2002. http://www.ieer.org/latest/npt02pw.html

6. Pakistan and Nuclear Terrorism

The security of Pakistan's nuclear arsenal was a major concern expressed in the United States in the immediate aftermath of the terrorist attacks on September 11, 2001, especially after the United States launched air attacks on Afghanistan on October 7. These fears were heightened by television images and newspaper reports of the street agitation launched by militant Islamic groups in Pakistan protesting US attacks on Afghanistan and by the decision of Pakistan's military government to support US policy. The most dreaded scenarios envisioned control of Pakistan's nuclear weapons or fissile material slipping into the hands of a pro-Taliban militant Islamic group or sympathizers in the military or intelligence agencies.

This was not the first occasion on which US security experts and official circles raised the issue of security of Pakistan's nuclear arsenal. These concerns were expressed occasionally in the aftermath of Pakistan's nuclear testing in May 1998, against the backdrop of the Pakistan military regime's growing ties with the Taliban government in Afghanistan and its active support to some extremist Islamic groups for their armed involvement in the insurgency in Indian-administered Kashmir. In an interview broadcast on the CBS program "Sixty Minutes" in October 2000, General Anthony Zinni, former commander of the US Central Command, expressed apprehensions that Pakistan's nuclear arsenal "could wind up in the hands of extremist religious leaders."[113]

6.1. Perceptions of Insecurity

The fears of al-Qaeda or other religious extremists acquiring nuclear weapons, fissile material, and technological know-how were heightened by speculative reports that they might have obtained ex-Soviet fissile material from the black market in Central Asia. They could also obtain expertise from unemployed ex-Soviet nuclear scientists. The other possible source for nuclear weapons and fissile material was perceived to be Pakistan. A number of possible scenarios about the vulnerability of Pakistan's nuclear program are outlined below:

1. The anti-government agitation launched by Islamic groups to protest Pakistan's support to US air attacks on Afghanistan in October 2001 created the specter of the agitation becoming nationwide. The fear was that a nationwide agitation could threaten the stability of the Musharraf regime. This did not happen. However, the risk of instability occurring persists because the Musharraf regime has not been able to expand its support base. If turbulence erupts for any reason (e.g., if it is perceived that the general elections were not conducted in a fair manner) and continues for some time, the future of the Musharraf regime and his post-election "civilianized" political order could be jeopardized. Such an agitation is also expected to raise the issue of Pakistan's support to US policy on Afghanistan. This could cause instability in the country, threatening the security of Pakistan's nuclear arsenal.

2. If Army officers and Inter-Service Intelligence (ISI) personnel sympathetic to extremist Islamic groups and the Taliban dislodge General Musharraf in a counter-

[113] Masood Haider, "Pakistan's N-Arms Worry Zinni," *Dawn*, October 17, 2000.

coup, Pakistan's nuclear arsenal would be under the control of an extremist Islamic regime. It is generally assumed that such a regime would be anti-United States and supportive of al-Qaeda.

3. Extremist Islamic elements might forcibly take over a nuclear facility and threaten to blow it up if the government does not accept their demands. They might remove fissile materials from the captured facility for later use.

4. The possible use of a truck bomb by an extremist Islamic group to force entry into a nuclear installation or to damage it cannot be ruled out. Even if it were not able to take over a nuclear facility, a bomb explosion on a nuclear facility would have propaganda value for the group, raising serious questions about the security arrangements of nuclear installations.

5. Collusion between an insider and an outsider could cause serious security problems. Extremist Islamic groups may cultivate an Islamic extremist working in a nuclear facility or an alienated employee may collaborate with outsiders for revenge or for material gain. An insider may pass sensitive information to an outsider (i.e., an extremist Islamic group) or facilitate a security breach or theft of nuclear materials.

6. An extremist Islamic group may try to obtain Soviet-era weapons-grade materials available on the black market in Central Asia or secure some radioactive materials in Pakistan for making dirty bombs.

The US print and electronic media, security experts, and the intelligence community have raised serious questions about the credibility of security arrangements of Pakistan's nuclear program. They were of the view that Pakistan's nuclear materials (both weapons-grade and non-weapons-grade) and nuclear installations could fall into the hands of extremist Islamic groups who could inflict nuclear terrorism on the United States or its troops in Afghanistan. David Albright, president of the Institute for Science and International Security, took an alarmist view of the security of Pakistan's nuclear program. He maintained that Pakistan pursued "an organizational culture that scorns security guidelines" because it had built its nuclear program through "illicit procurement and deliberate deception" that circumvented western export controls and the discipline of nonproliferation. He asserted that, "in the organizational culture of such a program, disaffected individuals could find plenty of justifications and opportunities to transfer classified information or sensitive items. Others might be disinclined to report the suspicious actions of colleagues. Some might even feel ownership over parts of the program and believe it is their right to sell their contributions for personal benefit."[114] He accused Dr. Abdul Qadeer Khan, Pakistan's ace nuclear scientist, of making an unsuccessful bid to sell "bomb designs" to Iraq in return for "handsome" monetary rewards.[115]

[114] David Albright, "Secrets, What Secrets?" *Scientific American*, December 2001. http://www. sciam.com/2001/1201issue/1201ramanabox2.html. See also Bill Keller, "Nuclear Nightmares," *New York Times Magazine*, May 26, 2002.
[115] Keller, "Nuclear Nightmares."

Other analysts have argued that Pakistan's nuclear materials and installations were not adequately secure against terrorist attacks or attempts to steal radioactive materials.[116] Some were perturbed by the links the Pakistan Army, and especially the ISI, had maintained with the Taliban in the past. The ISI had been instrumental in the rise of the Taliban in 1994 to 1996 and had helped to plan their military operations against their adversaries, especially the Northern Alliance in Afghanistan. Though Pakistan turned its back on the Taliban after September 11, 2001, many observers felt that some linkages and support for the Taliban persisted at the middle or lower levels of the ISI. The fear was that these Taliban sympathizers might compromise the security of nuclear materials and installations and enable the extremist Islamic elements to obtain some fissile material.[117]

These apprehensions were strengthened by a number of developments in the course of US military action in Afghanistan. First, two Pakistani scientists formerly associated with the nuclear program, Sultan Bashiruddin Mahmood and Chaudhary Abdul Majeed, were taken into custody for questioning in the last week of October 2001 on a tip from the US administration. They were questioned by Pakistani and US intelligence agencies for their alleged links with the Taliban. Sultan Bashiruddin Mahmood, a deeply religious person, had established a charitable trust, "Umah Tameer-I-Nau," for relief work in Afghanistan after his retirement from service. He met with the Taliban leader Mullah Omar and al-Qaeda leader Osama bin Laden. Two other retired nuclear scientists, known to be Mahmood's friends, were also questioned.[118] After intense questioning by Pakistani and US security personnel over two months, no evidence was found that they had passed on nuclear technical knowledge or sensitive information about Pakistan's nuclear program to the Taliban or bin Laden. The government of Pakistan closed the matter and released the two nuclear scientists, although they were kept under intelligence surveillance.[119]

Second, in an interview with a Pakistani newspaper correspondent in the first week of November 2001, Osama bin Laden made a vague claim of possessing nuclear weapons—a claim disputed by several Pakistani strategic analysts. He declared in the interview: "I have heard the speech of US President Bush yesterday. He was scaring the European countries that Osama wanted to attack with WMD. I wish to declare that if America used chemical or nuclear

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[116] Amir Mateen, "Pakistani Nukes: The Latest US Scare," *News*, November 11, 2001; Mansoor Ijaz and James Woolsey, "How Secure is Pakistan's Plutonium?" *New York Times*, November 28, 2001; Barton Gellman, "Fears Prompt US to Beef Up Nuclear Terror Detection," *Washington Post*, March 3, 2002.

[117] For the fears caused by the Pakistan Army's linkages with extremist-Islamic elements and the Taliban, see Matthew Bunn, John P. Holdren, and Anthony Wier, *Securing Nuclear Weapons and Materials: Seven Steps for Immediate Action* (Cambridge, MA: Belfer Center for Science and International Affairs, John F. Kennedy School of Government, Harvard University, May 2002), pp. 6, 52-53; Andrew Schneider, "Elite US Team Works to Keep Nuclear Bombs From Terrorists," *St. Louis Post-Dispatch*, October 21, 2001.

[118] *Daily Khabrian*, October 25 and 27, 2001; *News*, October 26 and November 11, 2001; Amjad Bashir Siddiqi, "Pak Scientist Regrets Meeting Osama, Omar," *News*, March 19, 2002; Arshad Sharif, "Assets of Nuclear Scientist Frozen," *Dawn*, January 31, 2002; David Sanger, "Nuclear Experts in Pakistan May Have Links to Al-Qaeda," *New York Times*, December 9, 2001; Peter Baker, "Pakistani Scientist Who Met Bin Laden Failed Polygraph, Renewing Suspicions," *Washington Post*, March 3, 2002.

[119] Kamran Khan, "The Probe Ends," *Weekly Independent*, May 9-15, 2002, p. 6.

weapons against us, then we may retort with chemical and nuclear weapons. We have the weapons as a deterrent."[120]

Third, the leader of a pro-Taliban Pakistani Islamic party, Jamiat-ul-Ulema-I-Islam (JUI), Hafiz Hussain Ahmad, said that the Taliban could use nuclear weapons in their defense and that they were close to acquiring nuclear weapons capability. The Taliban ambassador based in Islamabad contradicted the statement of the Pakistani leader, but his statement could not remove Western apprehensions.[121]

Fourth, an article by Seymour M. Hersh in *The New Yorker* in November 2001 also fueled speculations about the security of Pakistan's nuclear program. Describing how the Musharraf regime could lose control of Pakistan's nuclear program, Hersh claimed that an elite US Army unit was in training with an Israeli special operations unit, known as Unit 22, in preparation for taking control of or destroying Pakistan's nuclear weapons and installations if there ever arose a danger of their falling into the hands of extremist Islamic elements.[122]

The US administration denied that any army unit was being prepared for taking over Pakistan's nuclear installations. However, US security experts, including those associated with the US administration, did talk about a military operation to secure or remove Pakistan's nuclear weapons and fissile material if extremist Islamic groups threatened these. *Newsweek* quoted official sources saying that Marines could be sent to safeguard Pakistan's nuclear weapons and materials.[123] David Albright also refers to various suggestions for dispatching the US forces to Pakistan to secure its nuclear arsenal in an emergency. He, however, describes this as an "extremely difficult and dangerous option."[124] Another analyst describes direct military action as an "option to block access to nuclear weapons or materials by a radical successor government" in Pakistan, but he advises that there is a need to address a number of issues before embarking on such an operation. These issues include "military feasibility, potential risk of loss of life among innocent civilians, risk of wider conflict and regional as well as global consequences."[125] Some people talked of a joint US, Israeli, and Indian military action "if there was any doubt about the custody of Islamabad's nuclear arsenal."[126]

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[120] For the text of the interview, see Hamid Mir, "Osama Claims He Has Nukes," *Dawn*, November 10, 2001; see also Tim Weiner, "Bin Laden Has Nuclear Arms. He Tells Paper," *New York Times*, November 10, 2001.

[121] Hasan Askari Rizvi, "Nuclear Assets are in Safe Hands," *Dawn*, November 12, 2001; Bob Woodward, Robert G. Kaiser, and David B. Ottaway, "US Fears Bin Laden Made Nuclear Strides," *Washington Post*, December 4, 2001.

[122] Seymour M. Hersh, "Watching the Warheads: The Risks of Pakistan's Nuclear Arsenal," *New Yorker*, November 5, 2001.

[123] John Barry, "Priority: Pakistan Nukes," *Newsweek* (International Edition), November 12, 2001; C. Raja Mohan, "Securing Pak Nuclear Arsenal," *Hindu* (Madras), October 25, 2001.

[124] David Albright, "Securing Pakistan's Nuclear Weapons Complex," paper presented at the 42nd Strategy for Peace Conference, Stanley Foundation, October 25-27, 2001. http://www.isis-online.org/; Bruce Blair, "The Ultimate Hatred Is Nuclear," *New York Times*, October 21, 2001.

[125] Lewis A. Dunn, "Balancing Nuclear Security and Nonproliferation," in *A New Equation: US Policy Towards India and Pakistan After September 11* (Working Papers), Washington, D.C.: Carnegie Endowment for International Peace, May 2002, pp. 31-32.

[126] "A Buyer for the Bomb," *Far Eastern Economic Review*, November 22, 2001; Jawad Naqvi, "New Delhi Slams Speculation on N-site Attack," *Dawn*, October 23, 2001.

6.2. Official Postures

The press reports of a possible US attempt to secure or destroy Pakistan's nuclear weapons and nuclear installations were generally resented in Pakistan at the nonofficial and official levels. A number of political analysts and Islamic groups maintained that having failed to stall Pakistan's nuclear program in the past, the United States was now using the cover of counterterrorism to undermine or take over Pakistan's nuclear program. Some expressed the apprehension that the United States could use its aircraft and troops based in Pakistan or flying over Pakistan for its operations in Afghanistan for dropping paratroopers to take over nuclear installations. The *Daily News* commented in an editorial that most westerners are "mighty scared of these dreaded weapons falling into the hands of Islamic extremists and terrorists. But many Pakistanis also have the same fear of these assets going under undesirable control. But most of them think that the danger is of India, the United States and even Israel getting hold of these under cover of this Afghan war or its later extension to other places."[127] There were suggestions that Pakistan should make it clear to the United States and other states that it would resist any attempt to forcibly occupy Pakistan's nuclear installations.[128]

The government of Pakistan took strong notice of these speculative reports and repeatedly assured the international community that its nuclear installations and assets were safe and that additional safeguards had been introduced after September 11. Pakistan's Foreign Minister Abdul Sattar issued a special statement emphasizing that Pakistan's nuclear assets were "under foolproof custodial control" and that "any apprehension that the [nuclear] assets might fall into the hands of extremists is entirely imaginary – a product partly of distortion caused by TV images magnifying the sights and sounds of protesters."[129] General Pervez Musharraf said in a press conference in New York that Pakistan's nuclear program was under "very strong custodial control." He further said that the press reports that the Pentagon might have plans to "pinch" or "neutralize" Pakistan's nuclear weapons to prevent them from falling into the hands of extremist Islamic groups had "a very negative impact on the public mind" in Pakistan.[130]

The official US disposition toward the security of Pakistan's nuclear arsenal was rather cautious. Expressing their determination to keep WMDs out of the reach of terrorists, senior US officials communicated their apprehensions about the security of Pakistan's nuclear arsenal to the Pakistani authorities through diplomatic channels.

Nuclear safety and security issues were discussed when Secretary of State Colin Powell and the Director of the Central Intelligence Agency (CIA) George J. Tenet visited Islamabad in October and December 2001 respectively. Powell said in a press statement that General Musharraf "understands the importance of ensuring that all elements of his nuclear program were

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[127] "N-Weapons Security," *News*, November 9, 2001; see also the editorial entitled "Stable Pakistan: Unfounded American Fears and Us," *Daily Nawa-i-Waqt*, October 28, 2001.
[128] Zafar Nawaz Jaspal, "Safety and Security of Pakistan's Nuclear Capabilities," *IPRI Journal*, 2, 1 (Winter 2002). http://www.ipri-pak.org/winterjournal02/safetyandsecurity.htm
[129] *Press Release, Pakistan Ministry of Foreign Affairs*, November 1, 2001. http://www.forisb.org/FM01-133.html. See the statement of the spokesperson of the Pakistan Military on the security of nuclear installations, *News*, October 31, 2001.
[130] *Nation*, November 11, 2001.

safe and secure."[131] He expressed his government's willingness to extend technical assistance for improving the security arrangements of Pakistan's nuclear installations.

The US concern for the security of Pakistan's nuclear installations is part of its global efforts to make sure that terrorist groups are not able to obtain WMD, especially nuclear weapons and fissile material. Though the US administration concluded in February 2002 that al-Qaeda had not so far succeeded in obtaining nuclear materials for making a bomb,[132] this did not mean that al-Qaeda and other terrorist groups had given up the option of nuclear terrorism. Their search for fissile and radioactive materials is likely to continue.[133]

6.3. Pakistan's Nuclear Program and Infrastructure

Pakistan embarked on its nuclear weapons program in 1972.[134] The then-civilian government of Zulfikar Ali Bhutto decided in principle to explore the nuclear weapons option. However, no concrete measure was pursued until India's first nuclear explosion in May 1974. Pakistan signed an agreement with France in 1976 for the delivery of a nuclear reprocessing plant. This agreement soon ran into US opposition and France cancelled it in 1978. Meanwhile, Pakistan launched a covert operation to set up a uranium enrichment plant at Kahuta, near Islamabad. By the time US intelligence got wind of this clandestine effort towards the end of 1978, the enrichment plant was near completion. Pakistan began enriching uranium during the next few years.

The control of Pakistan's nuclear weapons program shifted to the Pakistan military after it dislodged the civilian government in July 1977 and assumed power under the Army Chief, General Zia-ul-Haq. There was no change in Pakistan's nuclear policy. The military government continued to pursue the weapons program. Since then, the military has controlled Pakistan's nuclear program. Even after the restoration of civilian rule in 1985, the military maintained overall control of the nuclear weapons program. However, the civilian government and the military shared the decision making on nuclear issues. The decision in May 1998 to explode nuclear devices was made by the then-Prime Minister Nawaz Sharif, but with major input from the military top brass.[135]

The coup led by General Pervez Musharraf in October 1999 combined control of the nuclear program and nuclear decision making in the military. With Pakistan's return to

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[131] *Nation*, November 2, 2001.

[132] Thom Shanker, "US Analysts Find No Sign Bin Laden Had Nuclear Arms," *New York Times*, February 26, 2002.

[133] David Albright, Correy Hinderstein, and Holly Higgins, *Does Al-Qaeda Have Nuclear Materials? Doubtful but*....," ISIS Commentary, March 1, 2002. http://www.isis-online.org/publications/terrorism/doubtful.html
See also David Albright, Kathryn Buehler, and Holly Higgins, "Bin Laden and the Bomb," *Bulletin of the Atomic Scientists*, 58, 1 (January–February 2002).

[134] Pakistan's nuclear program dates back to 1955. Pakistan obtained its first research reactor in 1965 from the United States, and it was installed at the Pakistan Institute of Nuclear Science and Technology (PINSTECH), Nilhore, near Islamabad. The Canadian-supplied first nuclear power plant (KANUPP) turned operational in 1971 at Karachi. Both the reactors are under the IAEA safeguards.

[135] For a study of the factors that shaped Pakistan's decision to undertake nuclear explosions in May 1998, see Hasan Askari Rizvi, "Pakistan's Nuclear Testing," *Asian Survey*, 41, 6 (November–December 2001), pp. 943-955.

constitutional rule in 2002, the earlier pattern of shared decision making is revived, although the military will continue to manage the actual control of the nuclear weapons program.

The size of Pakistan's nuclear program and nuclear arsenal is small, which makes it easy for the Army authorities to maintain a centralized and tight control over nuclear weapons and fissile material.[136] The nuclear devices exploded in May 1998 were based on HEU. Of late, Pakistan has acquired the capability to produce plutonium from irradiated fuel of nuclear reactors. It is not known if Pakistan has so far produced enough plutonium to build four or five nuclear weapons.

Pakistan's main uranium enrichment facility is at Kahuta (Khan Research Laboratories). Smaller uranium enrichment facilities exist at Sihala and Golra. Another place where uranium enrichment-related work might be under way is Gadwal, near Wah. Plutonium extraction work is done at the New Lab, near the Pakistan Institute of Nuclear Science and Technology (PINSTECH), Nilhore, and at Khushab in central Punjab. Pakistan has two nuclear power plants. One, which was set up with Canadian cooperation, is located at Karachi (KANUPP). It has been operating, with occasional closures, since 1971. Its design life was extended for another 20 years in 2001 by indigenous efforts.[137] The other nuclear power plant is located at Chasma (CHASNUPP). Based on China's Qinshan nuclear reactor, it was built by the Chinese under an agreement signed in December 1991. The Pakistan Atomic Energy Commission (AEC) took over the 50-megawatt (MW) power plant in September 2000.

Pakistan has a research reactor (PARR-l) at PINSTECH. Designed and built with US cooperation, it was upgraded from 5 MW to 9 MW and converted to low enriched fuel in 1990. Designed and built with Chinese cooperation, another research reactor (PARR-II) went critical in 1989. The PARR I and II reactors and the power reactors at KANUPP and CHASNUPP are under IAEA safeguards. Non-nuclear parts of nuclear weapons are built at the Defense Ordnance complex in and around Wah.

Radioactive materials are also available in civilian institutions. The Pakistan AEC manages 11 medical centers in different cities as well as agricultural research and food processing facilities. Some hospitals also have equipment with radioactive elements.

Nuclear weapons and fissile materials storage are located on military bases for ensuring their security. The military bases are self-contained communities that cannot be accessed easily by civilians. The advantage of this arrangement is that even if there is some agitation in the cities and consequent loss of control of some urban centers by the government, the nuclear arsenal's security is not necessarily threatened.[138]

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[136] Many security experts highlight the smallness of Pakistan's nuclear program as a factor facilitating its security. See, for example, Haider K. Nizamani, "Is Pakistan on Taliban and Nuclear Fuse?" *GSC Quarterly Newsletter*, No. 3 (Winter 2002). http://www.ssrc.org/gsc/newsletter3/nizamani2.htm

[137] See the statement of Dr. Ishfaq Ahmad, Chairman, Pakistan Atomic Energy Commission, *Dawn*, November 8, 2001.

[138] See Gurav Kampani, *Safety Concerns About the Command & Control of Pakistan's Strategic Forces, Fissile Material, and Nuclear Installations*, Monterey: Center for Nonproliferation Studies, Monterey Institute of International Studies, September 28, 2001. www.cns.miis.edu/research/wtc01/spna.htm

Pakistan's nuclear weapons are neither operational nor on hair-trigger alert. They are kept in unassembled form and the components stored separately at different locations. The fissile core is separated from nonnuclear components. It is possible that the weapons minus the fissile cores are mounted on delivery vehicles and the fissile cores stored separately. General Mirza Aslam Beg (Chief of Army Staff, 1988 to 1991) said in June 2001: "We have a bomb-in-the-basement policy where not even a bomb is placed over there, not a device, but components are there to put it together if needed… And then it is many miles away from the delivery system, that is, the missiles and the aircraft."[139] He maintained that the assembly of an operational nuclear weapon and mating it with the delivery system would take "two or three days."[140] Most Pakistani and a number of other security experts view the unassembled nature of Pakistan's nuclear arsenal as one security measure against theft and unauthorized use.[141] This separation is a procedural approach to security and use control rather than a technical one like that of a PAL system. However, adequate security is needed for the component parts stored separately. If the Pakistani authorities decide to assemble them in a situation of high tension between India and Pakistan, ensuring security to counter theft and unauthorized use will become vital.

Not much is known about the transportation of nuclear weapon components and fissile and other radioactive materials. Armored vehicles and aircraft are used for that purpose, and the Army and the ISI provide security. Special precautionary measures are taken when highly sensitive materials are transported. For example, if an aircraft is transporting nuclear materials, the relevant airports and airspace are closed to other aircraft. Secure transport by the National Logistics Cell, a transport company of the Army, may also be used under adequate security.

A National Command Authority (NCA) was set up formally in February 2000 for ensuring effective control and management of the nuclear program and to check the possibility of unauthorized use of nuclear weapons.[142] The NCA is assigned the responsibility for policy formulation, and command and control and management of Pakistan's nuclear and missile programs. It comprises the Employment Control Committee (ECC), a Development Control Committee (DCC), and a Strategic Plans Division (SPD). The ECC is the highest body in the NCA system and is headed by the head of the government. It also includes three members of the federal cabinet (Ministers of Foreign Affairs, Defense, and Interior), the Chairman of the Joint Chiefs of Staff Committee, the Chiefs of the Army, the Navy, and the Air Force, the Director General of the SPD, and technical advisers as required by the Chairman. The DCC is also chaired by the head of government and includes the Chairman, Joint Chiefs of Staff Committee, the Services Chiefs, the Director General of the SPD, and representatives of strategic organizations, including the Pakistan AEC, Khan Research Laboratories, and Pakistan Defense Industries. Its primary responsibility is to look after the development of nuclear weapons and other strategic assets. The SPD, headed by a serving Lieutenant General, is based in the Joint Services Headquarters. It serves as the secretariat of the NCA and undertakes the tasks of

[139] *News*, June 27, 2001.
[140] Elizabeth Neuffer, "A US Concern: Pakistan's Arsenal," *Boston Globe*, August 16, 2002.
[141] See Scott D. Sagan, "Terrorism, Pakistan, and Nuclear Weapons," in Michael Barletta, ed., *After 9/11: Preventing Mass Destruction Terrorism and Weapons Proliferation*, Occasional Paper No. 8, Monterey: Center for Nonproliferation Studies, May 2002, pp. 46-50.
[142] *Dawn*, February 3, 2000.

establishing a "reliable command, control, communication, computers and intelligence network for the NCA."[143]

In January 2001, the Pakistan Nuclear Regulatory Authority (PNRA) was established for control, regulation, and supervision of all aspects of nuclear safety and radiation protection. Pakistan is a party to the Conventions on Early Notification of a Nuclear Accident and Nuclear Safety, and to the Convention on the Physical Protection of Nuclear Material. In July 2000, Pakistan notified that nuclear substances and equipment could not be exported from Pakistan without a written clearance from the Pakistan AEC. The restricted nuclear substances and equipment were specified in that notification.[144]

6.4. Security Measures After September 11

Physical security measures have traditionally been tight for Pakistan's nuclear installations. As Pakistan initiated its weapons program in a clandestine manner, the Pakistani authorities were very sensitive about its confidentiality and security. Pakistan's nuclear installations, especially the uranium enrichment facility at Kahuta, always had extremely tight security with orders to shoot unauthorized persons trying to breach the outer security perimeters. There has not been any reported incident of unauthorized entry into Kahuta and other uranium enrichment facilities. The security authorities were also conscious of the threat of an air raid on Pakistan's nuclear installations on the lines of Israel's air attack on Iraq's Osirak nuclear facility near Baghdad in June 1981. In 1982 and 1983, unconfirmed reports of a possible Indian air attack on the Kahuta nuclear facility led to the adoption of stringent air security arrangements for the nuclear installations. These include, inter alia, closer monitoring, designation of the airspace on and around nuclear installations as no-fly zones, and installation of air defense systems such as anti-aircraft guns, and missiles. In December 1988, Pakistan and India signed an agreement not to attack each other's nuclear facilities. Despite this, air defense is integral to the security system for key nuclear installations.

Pakistan's military authorities reviewed these security arrangements in the immediate aftermath of September 11, 2001. The existing security arrangements were reinforced for all nuclear installations, especially the nuclear installations in Kahuta, Khushab, Chaghai Hills, and missile sites around Sargodha. Additional radars were installed to monitor aircraft movement in Pakistan's airspace and along the borders. On September 12, some airports, including Islamabad airport, were closed down for several hours for transporting nuclear weapon components and fissile material from known nuclear installations to different locations.[145] The Pakistani authorities were fearful of a possible air strike on nuclear installations. They also wanted to

[143] See the text of the official statement setting up the NCA. "Pakistan Announces Nuclear-Weapons Command-and-Control Mechanism, February 2000," Acronym Institute, n.d. http://www.acronym.org.uk/sasia/spmech.htm. For the organization chart of the NCA, see the website of Pakistan's Ministry of Foreign Affairs. http://forisb.org/NCA.html.
[144] *Dawn*, July 24, 2000.
[145] Amir Mir, "Umbrella on Nuclear Sites, " *Weekly Independent*, September 21-27, 2001, p. 1.

remove nuclear materials from the air corridors the United States might be using for air strikes in Afghanistan.[146]

In late October 2001, US Secretary of State Colin Powell, on a visit to Islamabad, offered to provide training facilities to Pakistani personnel for strengthening security of nuclear installations and materials. Pakistan accepted the offer. However, it is not known if the two governments adopted follow-up measures.

The PNRA streamlined nuclear disaster management in February 2002 by announcing a host of new measures for protecting "the plant and the society from hazards that could be man-made or natural." These measures included stricter quality controls and monitoring for infra-structure and equipment; multiple physical barriers to uncontrolled release of radioactive materials; radiation protection and acceptance criteria; automatic activation of safety systems; disaster limitation equipment and arrangements; reactivity and heat control system; sound electrical power structure; and independent verification of safety assessment. The PNRA also addressed resource issues in nuclear facilities such as division of responsibilities and quality of the technical and other staff.[147]

6.5. Political Dynamics

Many observers believe that Pakistan's political and economic vulnerabilities can create a situation in which the government is unable to maintain a credible security system for its nuclear installations and materials. Pakistan's nuclear weapons and nuclear materials may become vulnerable to theft or unauthorized use, and its nuclear installations may encounter accidents because of safety lapses, causing radiation leaks.

The track record of the Pakistani polity shows repeated failures "to establish enduring and credible political institutions."[148] There was "frequent breakdown of constitutional order, military rule, absence of elections at regular intervals, a selective enforcement of the rule of law and a poor tradition of accountability of rulers. The authoritarian traditions inherited from the colonial period persisted with the rise of a bureaucratic-military elite, which maintained a patron-client relationship with political leaders, institutions and processes."[149]

Pakistan experimented with three regular constitutions (1956, 1962, and 1973) and two interim constitutions (1947, 1972), in addition to a host of provisional constitutional orders issued by military governments. The lack of political continuity adversely affected consensus building and institutionalization in the polity. The generals alternated with political leaders in the exercise of power. Four Army Chiefs (Ayub Khan, Yahya Khan, Zia-ul-Haq, and Pervez Musharraf) ruled Pakistan for more than half of its independent life. Ayub Khan introduced a new constitution in 1962 to civilianize his military rule. Zia-ul-Haq and Pervez Musharraf intro-

[146] Molly Moore and Kamran Khan, "Pakistan Moves Nuclear Weapons," *Washington Post*, November 11, 2001.
[147] Ikram Hoti, "N-Disaster Management Mechanism Put in Place," *News*, February 22, 2002.
[148] Stephen P. Cohen, "The Nation and the State of Pakistan," *The Washington Quarterly*, 25, 3 (Summer 2002), pp. 109-122.
[149] Hasan-Askari Rizvi, "Pakistan," in Robert Chase, Emily Hill, and Paul Kennedy (eds.), *The Pivotal States: A New Framework for US Policy in the Developing World* (New York: W.W. Norton, 1999), p. 71.

duced far-reaching changes to the 1973 Constitution in March 1985 and August 2002 respectively to adopt some semblance of participatory governance while ensuring that they continued to control the political process from the top. Yahya Khan also had similar plans, but Pakistan's military debacle in Bangladesh in December 1971 caused the collapse of his military regime.

The periods of civilian rule (August 1947 to October 1958, December 1971 to July 1977, November 1988 to October 1999) were no less problematic. Political leaders often resorted to a free-for-all struggle for power, disregard of democratic norms, partisan use of state machinery and resources, and corruption. Consensus building and sustainability of participatory institutions and processes were neglected, making it possible for ambitious generals to sweep aside civilian governments at will.

The periodic breakdown of political and constitutional order accentuated existing ethnic, linguistic, and regional cleavages because these could not be accommodated in the political process, which caused political alienation and brought serious strains on the polity. These problems were accentuated by a sagging economy in the 1990s. Extensive borrowing from international sources caused a heavy debt burden. In 2001, Pakistan's total external debts were about $37 billion (US) and debt servicing was the biggest expenditure item in the national budget, followed by defense expenditure. When debt servicing and defense expenditure are combined, very few financial resources are left for the federal government, which has had to borrow from domestic and external sources to run the state and undertake development work.

Religious extremism began to develop against the backdrop of political uncertainties and deteriorating socio-economic conditions. Islamic political parties and groups always existed in Pakistan and pressed the government to adopt what they described as a truly Islamic system. Though some Islamic parties had a cadre of committed workers, none performed well enough in the elections to pose a serious threat to the government. Even today, Islamic political parties have limited electoral support and are not expected to result in more than 25 seats in the national and four provincial assemblies. However, a number of international, regional, and domestic factions have increased their street power and extremist Islamic elements have proliferated.

Pakistani and Afghan Islamic groups gained strength as material resources became available to them (mainly from the US CIA and Saudi Arabia) for bolstering their armed resistance to Soviet troops in Afghanistan (1979 to 1989). A number of Arab philanthropists also extended material support to the Afghan resistance. The United States and Egypt supplied weapons to them through Pakistan's ISI. Some weaponry was purchased on the black market in Pakistan's tribal areas on the Pakistan-Afghanistan border. The Afghan war period also witnessed the development of close interaction between Islamic militant groups of the Arab world and the Afghan resistance movement. A few thousand Arab volunteers joined the Afghan resistance movement to fight against the Soviet Union. After the Soviet withdrawal from Afghanistan in 1989, the United States gradually withdrew support to the Afghan Islamic groups but the Afghan warriors continued with the violent pursuit of their Islamic agenda. They targeted US interests and pro-US Arab regimes and became directly involved in Islamic causes in different parts of the world, including Kashmir, Bosnia, and Chechnya.

Pakistan's military government of General Zia-ul-Haq projected itself as the front-line state in the fight against Soviet troops in Afghanistan and patronized the Afghan Islamic

resistance, which helped to boost the fortunes of his regime at the global level. In the domestic context, he pursued Islamization and cultivated orthodox and extremist Islamic groups (most of which were involved in the Afghan war) in order to gain political legitimacy and to undercut the support of his political adversaries. State patronage coupled with international support in the context of the Afghan war strengthened Islamic orthodoxy and extremism in Pakistan.

The Pakistani military authorities, especially the ISI, developed strong linkages with Afghan and Pakistani Islamic groups during the Afghan war period. They continued with this relationship after the withdrawal of Soviet troops from Afghanistan for two major reasons. First, they wanted to ensure that a pro-Pakistan government came to power in post-Soviet Afghanistan, and were thus closely involved in intra-Afghan politics. In 1994, the ISI was instrumental in the emergence of the Taliban movement in Afghanistan, which captured Kabul in September 1996. Second, the ISI dispatched some of these extremist Islamic groups to Indian-administered Kashmir to step up the ongoing insurgency there.[150]

Most Pakistan-based extremist Islamic groups involved in post-Soviet Afghanistan and Indian-administered Kashmir belonged to the Deobandi or Ahle-Hadith persuasions of Islam, known for their extremist views and hard line on social, economic, and political issues. Their seminaries all over Pakistan, especially in the Northwestern Frontier Province (NWFP) adjoining Afghanistan, were the main recruiting grounds for volunteers to fight along with the Taliban in Afghanistan or in Kashmir. Some of the well-known groups included Harkatul Ansar, Harkatul Mujahideen, Lashkar-e-Taiba, Sipah-e-Sahaba, and Jaish-e-Mohammad. Some of these groups interacted with al-Qaeda.[151]

Pakistan's military authorities viewed the reinforcement of the insurgency in Kashmir through these extremist Islamic groups as a relatively low-cost strategy for "bleeding" India. However, while "bleeding" India, Pakistan began to bleed itself. The extremist Islamic groups began to use weapons at their disposal and training in Afghanistan to pursue their partisan-religious agenda within Pakistan. They attacked or killed those who did not share their perspective on Islam. This increased religious-sectarian violence and killings in Pakistan[152] and threatened civic order and peace, which adversely affected the prospects of new investment in Pakistan. The domestic fallout of their support to the extremist religious groups perturbed the military government. It adopted tough measures to contain religious-sectarian violence in 2000 and 2001. However, as the military government needed these extremist Islamic groups for pursuing its agenda in Kashmir, it often backed out of strict measures against them.

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[150] For an in-depth study of the linkages between the ISI and the Afghan resistance, especially the Taliban, see Ahmad Rashid, *Taliban: Militant Islam, Oil and Fundamentalism in Central Asia* (New Haven: Yale University Press, 2001).

[151] For an analysis of origins and dynamics of extremist Islamic groups in Pakistan and Afghanistan, see M. Ehsan Ahrari, *Jihadi Groups, Nuclear Pakistan, and the New Great Game* (Carlisle, PA: Strategic Studies Institute, US Army War College, August 2001); Saeed Shafqat, "From Official Islam to Islamism: The Rise of Dawat-ul-Irshad and Lashkar-e-Taiba," in Christophe Jaffrelot (ed.), *Pakistan: Nationalism without a Nation?* (New Delhi: Manohar, 2002), pp. 131-147.

[152] For a study of religious-sectarian violence in Pakistan, see Abbas Rashid, "The Politics and Dynamics of Violent Sectarianism," in Zia Mian and Iftikhar Ahmad (eds.), *Making Enemies, Creating Conflict: Pakistan's Crises of State and Society* (Lahore: Mashal, 1997), pp. 27-49.

The military government turned its back on the Taliban in Afghanistan and the extremist Islamic groups in Pakistan after September 11, 2001. It mustered enough strength to stand up to them in the wake of the devastation caused by terrorism in the United States, the international consensus to adopt the toughest possible measures against terrorism, and a US commitment to support Pakistan in return for joining the international coalition for counterterrorism.

Pakistan opened its airspace for US aircraft and provided logistical, communications, and emergency support to US military operations in Afghanistan. The top command of the ISI was reshuffled on October 7, a few hours before the United States launched air strikes in Afghanistan, to rid the ISI command of officers sympathetic to the Taliban. The ISI shared information on Afghanistan with US military authorities. Subsequently, the Federal Bureau of Investigation (FBI) was allowed to operate in Pakistan for rounding up religious extremists, especially the remnants of the Taliban and al-Qaeda, who had secretly slipped into Pakistan after the Taliban lost control of Afghanistan. Pakistan stationed up to 100,000 troops on the Pakistan-Afghanistan border to check infiltration and to engage in joint operations with US troops in Pakistan's tribal areas for tracking down the remaining Taliban and al-Qaeda personnel.

Pakistan's partnership with the United States against counterterrorism yielded economic rewards for Pakistan. The United States gradually lifted all economic sanctions against Pakistan, dating back to October 1990, when it imposed the first set of economic sanctions against Pakistan.[153] The United States offered bilateral economic assistance of about $1 billion in 2002, and the International Monetary Fund (IMF) and the World Bank offered long-term assistance for poverty reduction and social development. The European Union (EU) allowed more trade facilities and the Aid-to-Pakistan Consortium (based in Paris) rescheduled most of Pakistan's debts for 38 years on favorable terms, thereby reducing the debt servicing and repayment burden. This economic assistance has offered Pakistan an opportunity to work toward overcoming the acute economic crisis that has often raised the specter of Pakistan slipping into widespread anarchy.

Pakistan's post-September 11 policies have angered the extremist Islamic groups who describe these as a betrayal of Islam under US pressure. Initially, they launched street agitation to force the government to change its pro-US policies. When this agitation did not accelerate because other sections of the population and the major political parties did not join in, they appealed to the Army personnel to resist the decision of the top commanders. This also did not work.

The extremist Islamic groups were outraged when some of the leading groups were banned and their leaders arrested in January 2002, followed by joint Pakistan-US military operations in the tribal areas. Similarly, they resented the permission granted to the FBI to function in Pakistan for counterterrorism. It was in this context that they vowed to dislodge the

[153] Pakistan was under four types of US sanctions on September 11, 2001. First, nuclear-program-related sanctions were imposed against Pakistan in October 1990, under the Pressler Amendment (1985), which suspended all military sales and bilateral economic assistance to Pakistan. Second, new economic sanctions were imposed after Pakistan carried out nuclear explosions in May 1998. (These sanctions also applied to India because it had conducted nuclear tests earlier that month). Third, additional sanctions were imposed after the military takeover in Pakistan in October 1999. Fourth, the United States imposed limited sanctions for Pakistan's alleged violation of the missile technology control regime.

Pakistan government and began to engage in bomb explosions and commando assaults on newsworthy targets in different parts of the country in order to undermine the credibility of the government, cause confusion and uncertainties in the society, and derail the economy. Bomb explosions, terrorist attacks, and religious-sectarian killings by these elements haunt the present-day Pakistan.

6.6. How Credible Is the Threat?

The most pessimistic and alarming scenario for the future of Pakistan and the safety and security of its nuclear arsenal is that Pakistan will increasingly become ungovernable. The writ of the government will be extremely limited or nonexistent as socio-economic pressures intensify, ethnic and regional discontinuities sharpen, and cultural and religious-sectarian intolerance overwhelms the polity. As sophisticated weapons are easily available and several Islamic groups have sufficient experience and motivation to resort to violence in pursuit of their agendas, the competing groups can attempt to settle their scores by resorting to violence. This will further erode the writ of the already tottering government's authority. This can produce acute political instability, economic turmoil, and societal anarchy. A high degree of turbulence can cause serious threats to the safety and security of Pakistan's nuclear program.

However, the probability of such a scenario unfolding is minimal. Pakistan's state structure may be under stress, but two of its institutions, the military and the bureaucracy, are sufficiently strong and cohesive to ensure the functioning of the state, although they lack the vision to transform it. The changes in Pakistan's policies after September 11 and especially the availability of international diplomatic and economic support offer new opportunities to Pakistan to reverse the political and economic drift. Pakistan's economy has shown reasonable improvement in the post-September 11 period, although it is still not out of trouble.

The probability that extremist Islamic groups will overwhelm the state is also low. While they do have an ideologically committed cadre, the weaponry, and the experience to engage in violence, they are not expected to succeed in a head-on collision with the Pakistani state. They owe a good part of their strength to the patronage extended to them by Pakistan's military and intelligence authorities. The non-availability of this support has weakened them. Furthermore, these Islamic groups are not a united or monolithic entity. They differ sharply because of denominational differences and personality clashes. Not all Islamic groups have violent agendas. A number of Islamic groups and parties and leaders of Islamic seminaries (madrasas) maintain that these extremist groups have undermined Islam by engaging in terrorism within and outside Pakistan.

There is hardly any prospect of an extremist Islamic movement led by a cleric, like Khomeini in Iran, taking over the Pakistan state and declaring war on India and the United States. However, the extremist Islamic elements have sufficient capability to resort to violence or engage in terrorist activities from time to time and thus threaten political stability and civic order. Alternatively, they can create enclaves for themselves in far and remote areas (especially close to the Pakistan-Afghanistan border) where the writ of the government may be restricted.

A third possible scenario is a coup or counter-coup led by an Islamist general. While the theoretical possibility of this development cannot be ruled out, its chances are remote in the near future. The consensus among Pakistan watchers is that the Pakistan military continues to be a highly professional, hierarchical, and disciplined force. The top command and Army headquarters led all previous coups. The Army Chief, Principal Staff Officers, and the Corps Commanders, who meet periodically to deliberate on domestic and security affairs, share decision making in the Army. They function on the basis of consensus that is implemented by the Army Chief in a given situation. Internal cohesion is also helped by the fact that the military looks after the material interests of its personnel in service and after retirement. The monitoring of "personnel reliability" for senior officers is strict, and they are not allowed to develop linkages with political groups or leaders or engage in religio-political activism.

Furthermore, the Army may use the Islamic elements to advance its goals but the senior commanders are not expected to let the initiative slip into the hands of the Islamic elements. The probability of a pro-Islamic counter-coup against a sitting Army Chief is extremely low. If a general assumes power, he is expected to represent the interests of the military as an institution rather than the agenda of a non-military political or religious group.

If General Pervez Musharraf is assassinated or disabled, much will depend on the consensus among the top Army commanders. They can either assume power under their senior-most officer or allow the constitutional procedures to take effect. In the latter case, the Chairman of the upper house of the Parliament, the Senate, assumes the presidency and new presidential elections are held within 60 days.

The most likely scenario is that power will alternate between the generals and civilian leaders and Pakistan will continue with its off-again, on-again march towards participatory governance. The Pakistani state will be able to function as a political and administrative entity, although its efficacy will vary, depending on internal and external pressures.

What are the implications of these scenarios for the safety and security of Pakistan's nuclear weapons, fissile and other radioactive materials, and nuclear installations? The apprehensions expressed about their safety and security are exaggerated but not totally unfounded.

Given the fact that Pakistan's nuclear program began in a clandestine manner, both civil and military governments have always been very sensitive about its confidentiality and security. Pakistan's nuclear arsenal, as discussed earlier, is under the security control of the Army with a clear command, control, and communication system. The nuclear program is viewed as a matter of pride and excellence, and is integral to Pakistan's security. The military authorities thus take its safe custody very seriously. Pakistan's nuclear weapons are not expected to fall into unauthorized hands.

However, Pakistan's extremist Islamic elements could attack a nuclear facility. This attack may take the form of an armed raid, truck bombs, hurled bombs, or remote-controlled explosions. Such an effort may or may not succeed but it would make a big news story, causing panic in Pakistan and abroad. If the terrorists were able to enter the main installation of a nuclear facility, they might blackmail the government or damage the installation. If they gained access to radioactive material, they might use it for making a dirty bomb. The greater

probability is that radiological material would be slipped out of Pakistan for use elsewhere. Islamic groups may be hesitant to use a dirty bomb within Pakistan due to the fear of losing goodwill at the popular level.

"Insider-outsider" collusion provides another possibility for undermining security. An extremely religious person may be vulnerable to appeals of an Islamic group and may consciously or unconsciously pass on sensitive information. Similarly, an alienated or disgruntled employee may conspire with interested outsiders for monetary gain or to manifest his or her anger. "Insider-outsider" collusion may compromise security, result in the theft of equipment or documents, or facilitate some terrorist action against a nuclear facility.

These security challenges are not insurmountable. However, any international military operation to take over nuclear installations or remove nuclear weapons or fissile material without the prior consent and cooperation of the government of Pakistan may be counterproductive. The Pakistan military is expected to resist such an attempt. The consequences could be disastrous if the Pakistani authorities perceived such an attempt as an attack from India.

The United States and the IAEA can extend advice, technology, and training for upgrading existing safety and security arrangements for Pakistan's nuclear facilities and materials. The areas that need attention are physical security and remote monitoring of nuclear facilities, a PRP, transportation and communications, and methods for coping with nuclear accidents and radiological contamination.

7. India and Nuclear Terrorism

In an early work, Paul Leventhal and Brahma Chellaney drew attention to the threat of nuclear terrorism in South Asia.[154] Their view that the threat was mounting was based on four long-term trends: the rapidly expanding nuclear programs of India and Pakistan, their growing stockpiles of nuclear materials, the enduring problem of terrorism faced by both countries, and the increasing technical sophistication of terrorist groups. Since September 11, some attention has been given to the potential for nuclear terrorism, particularly because of the discovery of linkages between al-Qaeda and Pakistani nuclear scientists.[155] Nonetheless, published writings on the nature and extent of the threat, particularly with reference to India, have been cursory.[156] This section provides an overview of the terrorist threats faced by India, its nuclear infrastructure and vulnerabilities, and the efforts undertaken to combat terrorism (including nuclear terrorism) since September 11. Because of the inherently secretive nature of the subject, hard evidence is relatively sparse. Nevertheless, it is possible to arrive at a general understanding of the extent of the problem and of what needs to be done.

7.1. The Enduring Terrorist Threat

Perhaps the most remarkable political characteristic of Indian society has been the steady growth of democratic institutions and values since independence in 1947. Nevertheless, militancy and violence have been constant features of the Indian political landscape. The process of uneven economic development has been accompanied by relentless struggles among a plethora of social groups divided by caste, language, tribe, and religion competing for an adequate share of a relatively small economic pie. The volatile political environment has bred recurrent outbreaks of violence, often of an ephemeral and localized character, but periodically in the form of movements espousing the use of force against the state as well as against civilian targets. These movements are often associated with criminal activity (e.g., drug smuggling and gun running), and frequently draw sustenance from adversary states (China in the 1950s and 1960s, Pakistan since the 1980s). Over the decades, there has been a distinct trend toward ever-higher levels of violence.[157] The government of India has followed a customary carrot-and-stick strategy in response, alternating between the use of force to suppress militants and negotiation to accommodate them.[158] Mushrooming agitations and insurgencies have either died down or been contained. Overall, the integrated character of the Indian political union has crystallized

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[154] Paul Leventhal and Brahma Chellaney, *Nuclear Terrorism: Threat, Perception and Response in South Asia*, Nuclear Control Institute, Washington, D.C., October 10, 1988.

[155] "Terrorists Courted Pak N-Scientists," *Hindustan Times*, November 12, 2001.

[156] S. Gopal, "Nuclear Terrorism: Relevance and Prospects in South Asia," Paper No. 359, *South Asia Analysis Group*, November 10, 2001, http://www.saag.org/papers4/paper359.html; Achin Vanaik, "Nuclear Terrorism: A New Threshold?" *Economic & Political Weekly*, January 26, 2002, http://www.epw.org.in/showArticles.php?root=2002&leaf=01&filename=4013&filetype=html; J. V. Deshpande, "Nuclear Terrorism and All That," *Economic & Political Weekly*, April 6, 2002, http://www.epw.org.in/showArticles.php?root=2002&leaf=04&filename=4320&filetype=html. The latter two are more in the nature of a polemical exchange.

[157] Rakesh Gupta, "India: Towards A Political Economy of Intra-State Conflicts," *Faultlines*, Vol. 5 (n.d.). http://www.satp.org/satporgtp/publication/faultlines/volume5/Fault5-9rgupta.htm (Downloaded August 19, 2002).

[158] Kanti Bajpai, "Diversity, Democracy, and Devolution in India," in Michael E. Brown and Sumit Ganguly, eds., *Government Policies and Ethnic Relations in Asia and the Pacific* (Cambridge, MA and London: MIT Press, 1997).

steadily, and is hardly questioned by the great majority of people. Nonetheless, political turbulence has been – and remains – a prominent feature of contemporary life, and terrorism an inescapable part of it.

While much attention has been given to the Islamic threat in recent years, the Indian experience has encompassed a wide variety of terrorist and similar violent threats.[159] During the 1980s, the chief center of terrorist activity was the state of Punjab, where Sikh extremists engaged in a secessionist movement that took a heavy toll in lives, including that of Prime Minister Indira Gandhi. A recent report states that as many as 32 groups have been officially banned under the Prevention of Terrorism Act (POTA).[160] These include not only terrorist groups active in Kashmir, such as the Jaish-e-Mohammed, but also non-Muslim terrorist groups such as the less-known Tamil Nadu Liberation Army (TNLA) in the south and the Akhil Bharatiya Nepali Ekta Samaj (ABNES) in the north. The genesis of current terrorist movements has been internal in most cases, as with those in Kashmir in the north, and Assam and Tripura in the northeast.[161] Some violent political movements have sought structural political change rather than secession or autonomy, for instance, the Maoist Communist Centre (MCC) and the People's War (PW), both of which are very active in northern and eastern India.[162] Domestic political violence has the potential to breed more such movements. Events like the severe anti-Muslim riots in Gujarat in 2002 could give rise to social polarization and terrorism.[163]

However, spillovers from neighboring countries have been common. Notably, the secessionist movement in Kashmir has drawn support from the Pakistan government, and attracted a large number of non-Kashmiris, who have given it an increasingly Islamic-fundamentalist character.[164] The prolonged Tamil-Sinhala conflict in Sri Lanka has had powerful effects on Indian politics, including the assassination of former Prime Minister Rajiv Gandhi (1991) by the Liberation Tigers of Tamil Eelam (LTTE). The Chief Minister of the Indian state of Tripura has accused Bangladesh officials of harboring terrorists active in his state.[165] State support aside, terrorist groups may have their own linkages, as in the case of the

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[159] For an incomplete list that illustrates this variety, see "Armed Groups in South Asia," Institute for Peace and Conflict Studies, New Delhi. http://www.ipcs.org/nmt/milgroups/mg-index.html (August 8, 2002).

[160] "TNLA, TNRT, ABNES Banned Under POTA," *Hindustan Times*, July 3, 2002.

[161] D. Suba Chandran, "Militant Groups in Kashmir: An Analysis," Institute for Peace and Conflict Studies, New Delhi, Article No. 258, September 6, 1999, http://www.ipcs.org/issues/articles/258-ip-suba.html; Mahadev Chakravarty, "Insurgency in Tripura: Some Trends," *Economic and Political Weekly*, June 23, 2001, http://www.epw.org.in/showArticles.php?root=2001&leaf=06&filename=3149&filetype=html; Monirul Hussain, "State, Identity Movements and Internal Displacement in the North-East," *Economic and Political Weekly*, December 16, 2000, pp. 4519-4523.

[162] K. Balchand, "Spreading Tentacles," *Hindu*, August 11, 2002.

[163] On the Gujarat riots, see Anjali Mody, "Genocide in the Land of Gandhi," *Hindu*, March 10, 2002. On their broader implications for social stability, see Rajni Kothari, "Middle Ground Quakes," *Hindustan Times*, May 1, 2002. The killing of 32 people in the terrorist attack on the Hindu temple in Gandhinagar, Gujarat (September 2002) was apparently motivated by a desire to avenge the slaughter of Muslims in those riots. Manas Dasgupta, "Temple Siege ends," *Hindu*, September 20, 2002.

[164] Yoginder Sikand, "Changing Course of Kashmiri Liberation Struggle: From National Liberation to Islamist Jihad?" *Economic and Political Weekly*, January 20, 2001. http://www.epw.org.in/showArticles.php?root=2001&leaf=01&filename=2099&filetype=html

[165] P. P. Singh, "Smash Militant Camps in Bangladesh: Tripura CM," *Times of India*, August 21, 2002.

LTTE's links with the Maoist guerillas fighting in distant Nepal.[166] The recent emergence of a left-wing "people's war" in Nepal represents yet another potential threat that could spill over into India.[167]

How serious are these threats from the standpoint of nuclear terrorism? To date, none has shown direct evidence of a strong interest in mass destruction. Most of the violent movements cited above have localized interests and have not shown an inclination toward indiscriminate mass violence. The LTTE has resources, organizing capability and a capacity for suicide attacks, which would facilitate the handling of radiological materials without much care for self-preservation. However, the lesson of the Rajiv Gandhi assassination is that there are political limits to the use of violence. That single act lost the LTTE the sympathy of the Indian public.[168] The so-called "jihadis" or "holy warriors" fighting in Kashmir – mostly outsiders, as distinct from indigenous militants fighting for the localized identity of "Kashmiriyat" – do appear to have the mindset that would consider an act of mass annihilation "do-able." The one link between the militancy in Kashmir and nuclear capability discovered so far is a relatively tenuous one. Ayub Thakur, a London-based nuclear physicist formerly from Kashmir University in Srinagar who had also briefly worked with the Bhabha Atomic Research Centre (BARC) in Bombay, is known to have had close links with Kashmiri secessionism.[169] But, there is no evidence that Thakur's knowledge of nuclear science has had any bearing on his political activity. There appears to have been some linkage between the Harkat ul-Mujahedeen (HuM), an extremist group active in Kashmir, and al-Qaeda.[170] The HuM and other groups, such as the Lashkar-e-Taiba (LeT) and the Jaish-e-Mohammed (JeM) have shown a propensity for indiscriminate violence against civilians and hence a potential for nuclear terrorism. Given the shadowy links between these groups and al-Qaeda, and the latter's interest in acquiring nuclear capability (see Section 6 on Pakistan), the possibility of a nuclear terrorist threat remains a significant one.[171] At least one explicit threat to target nuclear facilities has been made. The day after the September 11 attacks in the United States, Sheikh Jamil-ur-Rehman, leader of the Tehrik-ul-Mujahideen, a terrorist group active in Kashmir, vowed to attack nuclear facilities in India.[172]

7.2. Nuclear Infrastructure and Vulnerabilities

India's AEC stands at the apex of an extensive nuclear infrastructure that incorporates warhead manufacture, electrical power production (14 reactors, with 6 more under construction), fuel fabrication and reprocessing, waste management, mining, research, and medical and industrial applications.[173] The physical security of nuclear installations is managed by an inde-

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[166] "Nepal Accuses LTTE of Supporting Maoists," *Times of India*, June 14, 2002.
[167] Rita Manchanda, "Escalating Civil War," *Frontline*, May 11-24, 2002. http://www.frontlineonnet.com/fl1910/19101290.htm
[168] Nirupama Subramanian, "It's No More Tiger Country," *Hindu*, July 28, 2002.
[169] Chandan Nandy, "London Conduit Was Nuclear Scientist," *Hindustan Times*, June 12, 2002.
[170] "In A Desolate House, Vestiges of a 1999 Hijacking," *New York Times*, December 6, 2001.
[171] Rohan Gunaratna, interviewed by Sonia Trikha, *Indian Express*, August 30, 2002.
[172] "Terrorists Vow to Hit Indian N-Sites," *Times of India*, September 12, 2001.
[173] For an overview, see Government of India, Department of Atomic Energy, *Annual Report 2001-2002*. Official publications, however, are not informative with respect to the military and security aspects of the nuclear program.

pendent body, the Central Industrial Security Force (CISF), a paramilitary force under the Ministry of Home Affairs. The CISF is also responsible for the protection of other high-risk facilities such as defense production units, space installations, oil refineries, and major ports, but little is known about how it actually organizes the security of nuclear facilities.[174] According to informed sources, the nuclear warheads located at BARC facilities are under military security. A study by P. R. Chari notes that the Indian Army provides air defense cover, security is strict, and access control is maintained through physical barriers and electronic systems.[175] We also know that the BARC has an ongoing program for the development of sophisticated security systems, such as a voice-activated phonetic identification system.[176] On the nature of the coordination among the three entities – the scientific bureaucracy, the Army, and the CISF – there is no public information. The Atomic Energy Regulatory Board (AERB) is empowered to regulate all civilian facilities, while the BARC has an internal review mechanism for military facilities. Though much of the AERB's function is related to preventing and responding to accidents, part of the counterterrorism function of controlling nuclear plants and other facilities and responding to emergencies would be covered by the same systems.[177]

No security system, of course, is foolproof. Numerous cases of theft have occurred over the years. For instance, in July 1998, the Central Bureau of Investigation recovered over 8 kilograms of natural uranium stolen from the Indira Gandhi Centre for Atomic Research (IGCAR) in Chennai.[178] Besides, it is difficult to ensure security over materials that are outside the control of the CISF, such as radiological sources in the possession of hospitals and industries. In July 2002, a gamma radiography camera containing iridium-192 with a radioactive strength of 19.7 curie was stolen during transportation in the northeastern state of Assam. A disturbing aspect of the incident was that the camera, a highly radioactive device, was left unlocked in the trunk of a public bus in a region plagued by terrorist activity.[179] Although AEC Chairman Anil Kakodkar claimed there was no need to panic, the fact remains that the camera was a powerful potential source for a dirty bomb.[180]

It is also known that terrorists have periodically penetrated zones of high-level military security. In mid-July 2001, five Army men were killed in an attack on a military camp in the Indian state of Jammu and Kashmir.[181] In early November 2001, a similar attack killed four

[174] The CISF's own website at http://cisf.nic.in/ does not even mention its role in the protection of nuclear facilities directly. For a more useful – but still sparse – overview, see Joseph A. Mallika, "The Central Industrial Security Force," Article No. 687, Institute for Peace and Conflict Studies, New Delhi, January 31, 2002. http://www.ipcs.org/issues/newarticles/687-mi-mallika.html

[175] P. R. Chari, "Protection of Fissile Material: The Indian Experience," *ACDIS Occasional Paper*, Program in Arms Control, Disarmament and International Security, University of Illinois at Urbana-Champaign, September 1998, p. 6.

[176] D. N. Srivastava, "Hi-Tech Computerized Security Management," *Nuclear India*, 34, 3–4 (September–October 2000). http://www.dae.gov.in/ni/nioct00/nioct00.htm

[177] For a review of these functions, see Nuclear Power Corporation of India Limited, *Emergency Preparedness in Nuclear Power Plants*. http://www.npcil.org/docs/emergency.htm (downloaded on August 8, 2002).

[178] "Uranium Racket Unearthed," *Indian Express*, July 23, 2002.

[179] "Radiation Scare in Assam," *Hindustan Times*, July 21, 2002.

[180] " 'No Chance of N-Material Falling into Wrong Hands,' " *Hindu*, July 21, 2002.

[181] "Day Two of Summit: 34 Die in Valley," *Tribune*, July 17, 2001.

soldiers, and two of the three terrorists involved escaped.[182] Two weeks later, ten soldiers and three civilians died in an assault by two terrorists.[183] In May 2002, three terrorists dressed in Army uniforms stormed an Army camp at Kaluchak near Jammu city and killed five soldiers and 25 civilians before being killed themselves.[184] A repetition of the Kaluchak massacre was narrowly prevented in August 2002 when militants entered a high-security zone housing senior police and civilian officials and their families before being intercepted.[185] Such incidents illustrate the relative ease with which areas under high levels of security cover are penetrated by small numbers of determined terrorists. Between April 2000 and May 2001, as many as six major fires occurred at Army ammunition dumps, some of them very large ones, such as the enormous fire that destroyed some 10,000 tons of ammunition in Bharatpur on April 28, 2000.[186] In at least some cases, sabotage was involved. While Army officials variously attributed the disasters to local geography, the malfunctioning of electrical equipment and, in one case, to an "act of God," intelligence officials disclosed that at least three of the fires were caused by sabotage.[187] The fact that no nuclear facilities have so far been penetrated is not in itself reassuring in this respect. It is also notable that when India's nuclear tests were being carried out in 1998, an unauthorized individual – an Army washerman who had jumped into a military truck with other soldiers because he wanted to help – was discovered by accident at the test site because a scorpion had stung him.[188] A more shocking security breach in a high-threat zone was the assault on India's Parliament by a small team of heavily armed terrorists in a car loaded with explosives in December 2001.[189]

Indian nuclear plants are characterized by a high level of built-in safety, which indirectly makes them relatively less vulnerable to sabotage. In addition, Canadian Deuterium Uranium (CANDU) plants are enclosed by heavy concrete walls, including a reactor vault of minimum four-foot thickness surrounding the nuclear core itself. Hence, it is unlikely that a large passenger aircraft crashing into the vault could cause a major disaster.[190] However, it is not known what effect an aircraft loaded with high explosives might have if it crashes into a typical Indian reactor building.

The two VVER-1000 type plants being built by Russia at Koodankulam in the southern Indian state of Tamil Nadu may be inherently vulnerable to an airliner crash. Weaknesses of existing plants of this type include the inadequate strength of walls and roof, the location of the control room at the lower levels of the reactor building (necessitating early evacuation in case of

[182] Mukhtar Ahmad, "Militants Storm J & K Army Camp, 4 Jawans Killed," *Rediff.com*, November 4, 2001. http://indiaabroad.com/news/2001/nov/04jk.htm
[183] Mukhtar Ahmad, "Militants Attack Army Transit Camp, 13 Killed," *Rediff.com*, November 18, 2001. http://indiaabroad.com/news/2001/nov/18kash.htm
[184] "Morning Terror in Jammu Casts Shadow on Days Ahead," *Indian Express*, May 15, 2002.
[185] "Army Officer, Four Rebels Dead in Kashmir Clash," *New York Times*, August 1, 2002.
[186] "Blowing Up in Our Faces," *Hindustan Times*, May 2, 2001, http://www.hindustantimes.com/nonfram/020501/editpage.asp#two; Vishal Thapar, "Ammo Fires: Not Quite Accidental," *Hindustan Times*, August 5, 2001, http://www.hindustantimes.com/nonfram/050801/detFEA02.asp
[187] Thapar, "Ammo Fires: Not quite Accidental."
[188] Raj Chengappa, *Weapons of Peace* (New Delhi: HarperCollins, 2000), p. 422.
[189] Ranjit Bhushan, "Shock Therapy," *Outlook*, December 24, 2001.
[190] "The Canadian Nuclear FAQ – Section D: Safety and Liability."

melt-through of the containment), and proximity of steam lines and isolation valves (hence, vulnerability to a single blast).[191]

Apart from relatively well-protected nuclear facilities, there are many sources of radiological materials that are much less secure. For instance, medical and industrial sources are very widely distributed and often inadequately guarded. Ironically, such sources are underlined as targets by warning signs that highlight their locations. These sources can very easily be stolen or released in the form of an RDD or dirty bomb. It bears repetition that an RDD may not be very lethal, but can generate fear, panic, and violence, the very goals that terrorists wish to achieve.

Finally, India's evolving nuclear doctrine and posture will have a bearing on the terrorist threat. As the Indian nuclear weapons infrastructure expands, new points of vulnerability will appear over time. At the time of writing, it is believed that Indian nuclear weapons are kept in a disaggregated state. Not only are warheads not "mated" with delivery vehicles, but the warheads themselves are unassembled: The core is stored separately from the assembly. While this reduces the risk of inter-state war, unassembled weapons remain vulnerable to terrorist threats. Terrorists might obtain a nuclear core and use it for a dirty bomb or, possibly, to build a nuclear weapon. However, this may change once the Indian command and control system crystallizes and there is pressure for a less passive nuclear posture. If weapons are actively deployed, the location points of nuclear warheads are likely to multiply, creating more potential targets.

Another possibility is that if India-Pakistan crises of the kind that have occurred regularly since the mid-1980s continue, the nuclear element, already an inescapable part of bilateral tensions, may rise. In the crisis that spanned the first half of 2002, India announced that it had "moved," but not "deployed," its nuclear-capable short-range *Prithvi* surface-to-surface missiles close to the border.[192] Future crises may involve a higher level of escalation in which nuclear weapons may be assembled, mated, and deployed in dispersed locations. Should that happen, the process of transportation and deployment of warheads would create fresh targets for terrorists. Notwithstanding the extensive precautions that surround nuclear weapons, mistakes and accidents do occur. We know, for instance, that several accidents have occurred with respect to US nuclear weapons.[193] The probability that terrorists may succeed in targeting Indian nuclear weapons during transportation or in storage at several sites is therefore significant.

Given the failures of Indian security systems even in terrorist-ridden high-security areas, diverse possibilities of nuclear terrorism can be anticipated. Some of these may be outlined as follows:

- In a worst-case, but least likely, scenario, determined terrorists may detonate a nuclear bomb either developed by them or obtained in ready-made form, for example, a small tactical weapon stolen from Russia. A nuclear explosion in a large Indian city would have horrific effects. One study has estimated that a 15-kiloton explosion in Mumbai

[191] Helmut Hirsch, "Vulnerability of VVER-1000 Nuclear Power Plants to Passenger Aircraft Crash," WISE, November 2001. http://www.antenna.nl/wise/terrorism/112001vver.html
[192] Vishal Thapar, "Prithvi Missiles Moved Near Border in Punjab," *Hindustan Times*, December 25, 2001.
[193] Chuck Hansen, "The Oops List," *Bulletin of the Atomic Scientists*, 56, 6 (November/December 2000), pp. 65-66.

would result in somewhere between 160,000 and 866,000 deaths.[194] A smaller explosion would cause much less harm, but would still have the potential to kill many thousands, and create panic and chaos. While the likelihood of such an event is low, it cannot be ruled out altogether.

- A somewhat higher probability would be a terrorist attack on an army installation where nuclear warheads are kept. If terrorists seized possession of the nuclear warheads, they might not be able to detonate the warheads directly. Nevertheless, they could conceivably explode a warhead and disperse radioactivity, creating serious effects. If a large city like Delhi or Mumbai were downwind of the detonation, the result has been estimated to be from 5,000 to 20,000 cancer deaths over some decades.[195]

- A less improbable event would be a terrorist assault on a nuclear plant. A small, well-armed team of terrorists dressed in military uniforms might force its way through security barriers and, perhaps with the help of an insider, gain access to a reactor or to a spent fuel storage area. A powerful conventional explosion might then directly release radiation, or cause a meltdown by damaging the containment system of a reactor. The effect would be similar to a major RDD, generating terror in nearby areas.

- A more plausible event would be a terrorist explosion of an RDD. The radiation released in this form in one or more public buildings in a major city would not cause great direct harm, but would nevertheless be "cost-effective" from the standpoint of a terrorist. It would create widespread fear, impose high economic costs by rendering large areas uninhabitable for a long time, and engender political tension and perhaps social violence and instability.

- Terrorists obtaining nuclear material may release some radiation and either threaten a nuclear explosion or more releases. Even a bluff creates a strong potential for nuclear blackmail, since it would be hard to discount the threat.

The wider repercussions of a nuclear terrorist incident may be considerable. For instance, if one or more RDDs were to be exploded in the city of Mumbai – say, in a nuclear version of the multiple bomb blasts of 1993 – the following sequence of events might occur. The immediate result would be widespread panic, followed by a chaotic mass movement of people desperate to escape the consequence of an unknown level of harm. Very possibly, there would be violence, with people fighting to get away by any means of transport available. The already overburdened streets would be jammed with fleeing vehicles caught in traffic snarls, and spreading lawlessness would be marked by looting and sporadic – perhaps even mass – bloodshed. Further, there might well be widespread sectarian violence pitting Hindus against Muslims (not unlike the mass killing of Sikhs in the wake of Prime Minister Indira Gandhi's

[194] M. V. Ramana, "Bombing Bombay? Effects of Nuclear Weapons and a Case Study of a Hypothetical Explosion," *IPPNW Global Health Watch Report No. 3*, International Physicians for the Prevention of Nuclear War, Cambridge, MA, 1999.

[195] Zia Mian, M. V. Ramana and R. Rajaraman, "Plutonium Dispersal and Health Hazards from Nuclear Weapon Accidents," *Current Science*, 80, 10 (May 25, 2001), pp. 1275-1284. The study focuses on accidents, but the effects of sabotage would be similar.

assassination in 1984). The incident would also generate immediate and intense hostility toward Pakistan as happened in late 2001 following the terrorist attack on India's Parliament. This in turn would very likely bring about an India-Pakistan crisis and raise the specter of war. While this may appear to carry a conjecture rather far, history offers numerous examples of relatively small incidents snowballing into great tragedies, most famously the "shot heard round the world" in 1914 that killed a little-known Austrian archduke and led to world war. Even if the worst did not happen, there would be mass misery and terror, public disorder, political crisis, rising costs across the board imposed by higher insurance rates, capital flight, diversion of domestic and international investment, and a cloud over the role of nuclear energy as a source of electrical power.

7.3. Responses to the Nuclear Terrorist Threat

Given its long-standing experience of secessionist violence, India has over the past few decades developed measures to guard against the general threat of terrorism. These include relatively high levels of security at airports and other critical facilities, the use of the armed forces to fight insurgencies, and the promulgation of anti-terrorist laws that provide the state with extensive powers. The intensified attacks by terrorists espousing the cause of Kashmir, especially after September 11, 2001, brought still greater efforts in this direction.[196] In October 2001, India issued the Prevention of Terrorism Ordinance (POTO), later to become the POTA, providing for 90 days' detention without trial, special courts to deal with terrorist cases, and police powers to intercept communications, which could be later presented as evidence in court. Passport and visa restrictions were tightened, as were laws designed to curb the financing of terrorism. Quick reaction teams were deployed at all major airports along with other enhanced security measures.[197] Security was tightened at vital installations relating to space and nuclear energy, refineries, and power utilities, at government offices, and at important commercial, religious, and historical centers. It was decided to create a National Disaster Management Agency (NDMA) and similar agencies at the level of the states to prepare comprehensive guidelines for disaster management, train paramilitary forces for rapid deployment in case of a terrorist attack (including a WMD attack), draw up lists of vulnerable targets, strengthen fire and medical services, and revamp communication networks.[198] In August 2002, it was announced that central and state security agencies would henceforth pool their knowledge resources though a new Multi-Agency Center (MAC).

All these broad measures contribute to countering the threat of nuclear terrorism. Additional specific measures include a decision to place almost all nuclear plants under "no-fly" or restricted zones for aircraft. However, the BARC establishment, which includes the country's designated weapons laboratory, remains at some risk because of the location of a backup runway at Mumbai airport.[199] In April 2002, the Chairman of the Nuclear Power Corporation announced

[196] For a detailed post-September 11 description of domestic and international measures undertaken by the Government of India, see United Nations Security Council, *Report by India to the Counter-Terrorism Committee Pursuant to Resolution 1373 (2001)*, Enclosure, Document No. S/2001/1278, December 27, 2001.
[197] India, Ministry of Home Affairs, *Annual Report, 2001-2002*, Chapter III.
[198] India, Ministry of Home Affairs, Press Release, October 5, 2001.
[199] Kalyan Ray, "Move to Put Nuclear Plants Under Restricted Zone," *Deccan Herald*, October 13, 2001.

that he was aware of the terrorist threat, and that special security drills had been conducted by the Department of Atomic Energy (DAE) and CISF staff at nuclear facilities.[200]

At the international level, India had already begun to develop numerous avenues of cooperation to counter the terrorist threat. By September 11, it had become a signatory to all the UN treaties relating to terrorism except one. It acceded to that exception – the CPPNW – in January 2002. It became a member of the South Asia Association for Regional Cooperation (SAARC) Regional Convention on the Suppression of Terrorism in 1987. It also established bilateral Joint Working Groups to address the terrorism issue with several countries. By late 2001, it had signed bilateral agreements on counterterrorism with eight countries and extradition treaties or agreements with 24. Bilateral cooperation with the United States reached significant levels soon after the September 11 tragedy. The Indo-US Joint Working Group on Counter-terrorism met regularly, established antiterrorism training programs (including a workshop on WMD for senior Indian officials in December 2001), and began developing cooperation on a wide range of issues that covered finance, homeland security, forensic capability, aviation security, and cyberterrorism.[201] Preliminary talks also began on possible US assistance to India for the security of nuclear plants.[202] Nuclear cooperation, however, faces difficult obstacles because of the nonproliferation concerns of the United States.

India has shown a serious interest in obtaining sensors for monitoring the India-Pakistan border and curbing the flow of terrorists into India.[203] Without doubt, border control remains the most difficult issue for India. The length and porosity of the India-Pakistan border makes unilateral control difficult. The terrorist attack on India's Parliament in December 2001 brought an intense confrontation between India and Pakistan. India engaged in a massive buildup of armed forces along the border in order to exert strong pressure on Pakistan to stop its support for extremist groups active in Kashmir. The outcome of this exercise in compellence – as yet unfinished at the time of writing – has an important bearing on the nuclear terrorism threat to India, since, as noted above, the "jihadists" fighting in Kashmir have the greatest potential for indiscriminate mass destruction.[204] In the meantime, the cross-border flow of terrorists and the periodic incidence of lethal attacks continue.

7.4. What Needs To Be Done

The nuclear terrorist threat to India is best seen in the scenarios outlined earlier in this section. Government officials have taken the threat seriously, and have undertaken a series of domestic and international responses to meet it. Nevertheless, the vulnerabilities evident even in high-security contexts reveal that the absence of a nuclear terrorist incident so far may have as much to do with lack of interest or effort on the part of terrorists as with the measures that deter them. Certainly, the experience of September 11 gives us reason to expect the highly improbable. Four areas that need to be attended to are:

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[200] R. K. Radhakrishnan, " 'Security Concerns Will Not Stop New Nuclear Plants,' " *Hindu*, April 4, 2002.
[201] "US to Help India in Border Vigil," *Hindustan Times*, January 22, 2002.
[202] Atul Aneja, "India, US Discuss N-safety Issues," *Hindu*, March 30, 2002.
[203] "India to Install Advanced American Ground Sensors on LoC," *Hindustan Times*, June 19, 2002.
[204] On India's turn to a compellence strategy, see Rajesh M. Basrur, "Kargil, Terrorism and India's Strategic Shift," *India Review* (forthcoming).

1. *Technology:* Counterterrorism requires technical sophistication, and considerable investment in order to achieve that. This means not only border monitoring, but control of nuclear facilities, including nuclear plants, research reactors, waste management facilities, and medical and industrial establishments that have physical possession of nuclear materials. The armed forces, which utilize nuclear materials for military purposes, constitute a separate and important category.

2. *Organization and Training:* The wide distribution of nuclear materials brings numerous organizations into contact with them. These include government organizations (the military, intelligence, the atomic energy establishment, police and paramilitary forces), medical centers, and industries. Control and supervision of the security of materials across organizations, especially during transportation, requires a comprehensive overview, planning, and coordination. A coordinating organization for this purpose is necessary to minimize the risks posed by terrorism. Officials who are likely to come into direct contact with a nuclear terrorist incident need to be trained for safety and crisis management.

3. *Public Information and Education:* In order to minimize confusion and chaos, it is necessary to create public awareness about the potential effects of nuclear terrorism. This involves integrating the official and unofficial media to disseminate information and encourage public confidence without causing unnecessary panic.

4. *Accountability:* Independent monitoring of nuclear-related organizations is important to ensure accountability. The role of an independently appointed executive body, or of a legislative committee analogous to Parliament's Public Accounts Committee, is crucial in this respect.

8. Recommendations

Nuclear terrorism encompasses a spectrum of potential threats from the elementary level of nuclear hoax and blackmail to the detonation of a nuclear bomb. While the effects of the former would almost certainly be devastating, those at the other end of the scale would still be of serious consequence. From the terrorist's standpoint, the lower part of the scale would be more cost effective and manageable. Nevertheless, the lesson of September 11 is that nothing can be discounted, and that the unexpected should be expected.

The probability of terrorist groups acquiring nuclear weapons in India and Pakistan is extremely low since both countries report keeping them in unassembled form, and because their components are stored separately. Terrorists are also unlikely to be able to manufacture an operational nuclear weapon of their own, given the difficulties involved in obtaining the required materials, facilities, and technical know-how. However, terrorist groups are more likely to resort to at least four types of nuclear terrorism. First, they might sabotage a nuclear facility (including a military facility) to release lethal radiation. Second, they could utilize a dirty bomb to disperse radiation. In either case, the result would be widespread panic and violence, perhaps even war. Third, they could take control of and threaten to blow up a nuclear facility in order to blackmail a government into accepting their demands. Fourth, they might engage in the clandestine transfer of nuclear materials out of India and Pakistan for use in some other part of the world.

8.1. National Measures

At the national level, it is imperative that the system of controls established to prevent nuclear terrorism be both technically and organizationally sophisticated. The costs involved may be high, but are justified by the potentially enormous damage and instability that can be caused by a nuclear terrorist incident. Regardless of partisan interests, all political groups (other than nuclear terrorists themselves) have a common interest in preventing terrorists from gaining access to nuclear materials and technology. Some desirable measures are enumerated below.

1. India and Pakistan must continue to track the numerous groups and individuals engaged in overt or covert violent activities or terrorism in their respective countries. Their movements, interactions, and transactions within and outside the country must be tracked in order to prevent them from carrying out nuclear terrorist acts.

2. Enhanced measures should be adopted to control the movement of goods and people across their respective international borders. Enhanced levels of surveillance of land borders and coastlines are necessary. Both countries need to have a centralized record of people entering or exiting the country, which could be accessed by immigration authorities from any port of entry or exit.

3. Both need to acquire modern technology and equipment to upgrade the physical security of nuclear weapons components, and nuclear materials and installations, including radioactive waste storage and disposal facilities.

4. Greater attention must be given to background checks of new entrants into their respective nuclear infrastructures. Strict scientific criteria and procedures should be adopted to verify periodically the reliability of personnel holding sensitive assignments. This will help secure the Indian and Pakistani nuclear programs against insider threats or from insider-outsider collusion.

5. Nuclear materials are vulnerable during transportation. India and Pakistan should acquire the latest technologies for packaging, sealing, and monitoring of fissile and radioactive materials during transportation, and obtain trucks or railway carriages especially designed for safe and secure movement of nuclear materials. Security of transportation demands that they also acquire updated equipment for real-time communication among transport vehicles, escorts, and a transportation operation center.

6. An autonomous and highly trained security force should be established for protecting nuclear facilities and materials instead of depending on a nationwide security agency that undertakes other assignments as well. Personnel may be transferred from other security agencies to the nuclear security agency, but the latter must be an autonomous organization devoted exclusively to securing nuclear facilities and materials. The agency must also oversee the security of materials and related facilities in the mining, medical, research, and industrial sectors.

7. There should be coordinated efforts among the various organizations that are related to the nuclear infrastructure. Coordinating bodies may be separate for military-related aspects, government-controlled power production, and private industry, but there must be a single autonomous body to ensure oversight and accountability.

8. Finally, provisions for disaster management are of the essence. These would include emergency response teams for tackling a security alarm or actual nuclear terrorist incident; wider arrangements involving the administrative apparatus, the police, hospitals, public health services, transportation systems, and the like for tackling a nuclear emergency; and the dissemination of information and confidence to the public through government and private media.

8.2. Bilateral Measures

Despite their long-standing hostility and recurring crises, India and Pakistan have a shared interest in thwarting nuclear terrorism. It is not in the interests of either to allow terrorist groups to obtain nuclear capability. Once it has obtained nuclear capacity in some form, a terrorist group would be hard to control. However amicable its relationship to a particular government, the possession of such enormous coercive power would, from that government's standpoint, give the group an unwelcome potential to change the domestic balance of power. At the very least, the group would be in a position to use its nuclear capability as leverage in extracting a high political price from even a friendly government. As states, India and Pakistan thus have a common stake in preserving their control over WMD.

Second, the occurrence of a nuclear terrorist incident can have far-reaching repercussions on strategic relations between India and Pakistan. If a terrorist group effected a radiation release,

say by means of a dirty bomb or an attack on a nuclear facility, there is every chance that the target country would treat it as a provocation by the other. This would then likely lead to a military confrontation that could assume far more serious proportions than anything the region has witnessed hitherto. In the unlikely event a serious nuclear incident – such as the detonation of a nuclear bomb by terrorists, or a highly damaging attack on a nuclear weapons site or a nuclear plant – should occur, the target state might even assume that it constitutes an attack by its adversary. If there is already a confrontation between the two rivals, as happens from time to time, the risk of war would be very high. The pressure to strike in reprisal would be hard to resist, with potentially disastrous results.

In this context, it is important to recall that India and Pakistan have in the past been able to cooperate on nuclear-strategic matters even in times of high tension. In December 1988, they signed an agreement to avoid attacking each other's nuclear facilities, to the terms of which they have adhered by exchanging lists of their respective facilities even at the height of confrontation. Similarly, both have consistently informed each other of impending missile tests in accordance with the Memorandum of Understanding signed at Lahore in 1999. Hence, there is room for optimism that the long-standing adversaries may cooperate in curbing the common threat of nuclear terrorism. The measures the authors recommend are:

1. Cooperation between the border security authorities of India and Pakistan in interdicting unauthorized movement of goods and people across their boundaries. They could share intelligence on these issues and, if needed, undertake joint operations to control illegal transactions and movements across their borders. The Pakistan Rangers and India's Border Security Force hold meetings twice a year to discuss border security. The scope of these meetings could be extended to cover issues pertaining to nuclear terrorism.

2. Monitoring the activities of transnational terrorist groups, exchanging information on these groups, and making joint efforts to disrupt their connections, transactions, and movements could be another measure. An agreement specifically designed to help each other combat nuclear terrorism could encourage cooperation.

3. A formal agreement on maintaining nuclear arsenals in a non-operational form could consolidate the tacit cooperation already in existence. This would not only strengthen strategic stability directly, but also help reduce the scope for terrorists to target nuclear weapons.

8.3. Role of the United States

The United States has a strong interest in ensuring peace and stability around the world. Terrorism transcends borders, and hence the United States has launched a worldwide effort to track down and combat terrorist networks. South Asia has been of particular interest to the United States because of the ongoing campaign to destroy the Taliban, al-Qaeda, and related groups, whose activities have spanned Afghanistan, Pakistan, and India. The United States also has a strong interest in preventing a war – potentially, a nuclear war – between India and Pakistan. Given, as we have seen, the risk that a nuclear terrorist incident could well unleash

war in the subcontinent, the US role in counterterrorism in the region has perforce to be a central one. In addition to working toward defusing tension between India and Pakistan and encouraging them to open a dialogue on their contentious issues, the United States can contribute to strengthening the safety and security of their nuclear programs in several ways, as follows:

1. The Indian and Pakistani systems for personnel reliability are outdated, limited in scope and lacking in sophistication. India and Pakistan can certainly benefit from some knowledge of the PRP utilized by the US nuclear program. Training workshops could be held for Pakistani and Indian personnel and relevant literature (manuals, guidelines, and procedures) could be made available to them.

2. The United States can extend useful assistance for safe and secure storage, transport, and disposal of nuclear waste.

3. The United States can help India and Pakistan to improve organizational practices to ensure better coordination among various organizations dealing with diverse aspects of their nuclear programs. Inadequate coordination and lack of cohesion among different actors engaged in nuclear program-related activities can undermine efficiency and make them more vulnerable to terrorism.

4. The United States can make modern technologies available to India and Pakistan to strengthen the safety and security of their nuclear programs. Some of the technologies and equipment include remote sensing, radiological sensors, video monitoring, alarms, and tamper-indicating seals.

These recommendations do not conflict with US obligations under the NPT, which calls upon the nuclear weapons states not to "assist, encourage or induce" any non-nuclear weapon state in manufacturing or acquiring nuclear weapons. These recommendations do not improve the bomb-making potential of India and Pakistan, nor do they encourage them to keep their nuclear arsenals in assembled and deployed form. A security breach in a nuclear facility can produce dangerous consequences. US policy makers should weigh the advantages of helping India and Pakistan strengthen security measures against nuclear terrorist threats vis-à-vis a rigid interpretation of the NPT. They may also be constrained by export restrictions on certain kinds of technologies and equipment. The United States could take up each category of assistance on a case-by-case basis.

Just as US policy makers will face constraints in offering security assistance, Indian and Pakistani policy makers are also likely to be wary in accepting US assistance. They will measure the benefits of US offers against the confidentiality imperatives of their own nuclear programs. In particular, they will not want US experts to have access to their nuclear weapons programs. There is a limit to what India and Pakistan can accept from the United States. However, despite some reservations on both sides, there are ample areas where the United States and the two South Asian states can work together for improving the safety and security of their nuclear programs. With both sides likely to guard their respective secrets zealously, the transmission of expertise is bound to be cautious and slow. Detailed blueprints need not be supplied. Rather, India and Pakistan require, apart from appropriate technology, guidance on best practices and frameworks that they can adapt to their specific needs.

8.4. Global Efforts

The nuclear terrorist threat is global in scope. Its main components – nuclear materials, terrorists, and targets – are not limited by political geography. Hence, all countries have an interest in controlling it. The nuclear nonproliferation regime, the IAEA, the UN, and regional organizations have all played some part in reducing the scope for terrorists to inflict nuclear blackmail or horror upon the world. Nevertheless, much remains to be done.

1. The ongoing war against terrorism must be sustained. Global cooperation is needed to identify, track down, and apprehend terrorist groups, beginning with those whose activities are known to be transnational. This will require the strengthening of inter-state information exchange and the establishment of arrangements for extradition of terrorists within the framework of the UN. Cooperation on these lines should be made obligatory.

2. The measures initiated by the IAEA to enhance cooperation with respect to the physical security of civilian nuclear facilities and materials should be continued and intensified. In order to ensure the diffusion of advanced monitoring technologies and best practices, the IAEA should be provided with additional funding and an expanded agenda. The creation of a special fund for assisting countries needing upgraded technology should be seriously considered.

3. The states possessing nuclear weapons should engage in a similar – perhaps informal at first – set of arrangements with respect to military nuclear facilities and materials. Regardless of inevitable tensions over how much can be given and how much received, some degree of cooperation can only be beneficial for all. Here, it is necessary to go beyond traditional objections to "rewarding" proliferators. Whether nations will or will not obtain nuclear weapons is determined by capabilities and interests, not by vague notions of reward and punishment.

4. Finally, there must be a serious effort to "build down" the vast arsenals of the United States and Russia. Future arms control agreements must eliminate weapons fully rather than place large numbers under storage, where they will continue to be potential targets for terrorists.

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